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RESEARCH AND DEVELOPMENT IN DATA PROCESSING FOR PUPIL PERSONNEL AND CURRICULAR SERVICES.

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A COMPREHENSIVE PUPIL PERSONNEL AND CURRICULAR DATA PROCESSING SYSTEM WAS DEVELOPED AND DEMONSTRATED FOR USE OF CALIFORNIA HIGH SCHOOLS. THIS SYSTEM WAS DESIGNED TO SERVE GROUPS OF SCHOOL DISTRICTS THROUGH REGIONAL, DATA PROCESSING CENTERS. THE OVERALL SYSTEMS PLAN, THE NECESSARY PROGRAMING ACTIVITIES, AND A TECHNIQUE FOR MASTER CODING WERE DELINEATED. ELEMENTS OF THE SYSTEM'S DESIGN WERE ORIENTED TOWARD PROVIDING BOTH TEACHING AND ADMINISTRATIVE ASSISTANCE IN REGISTRATION AND SCHEDULING, ATTENDANCE ACCOUNTING, GRADE REPORTING, AND TEST SCORING AND ANALYSIS. THE SYSTEM WAS PROGRAMED TO MAINTAIN CUMULATIVE RECORDS ON MASTER FILE TAPES, AT A REGIONAL DATA CENTER, ON EACH STUDENT IN THE PARTICIPATING SCHOOLS. (JH)

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Research and Development in Data Processing for Pupil Personnel and Curricular Services

COOPERATIVE RESEARCH PROJECT D-050

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CALIFORNIA STATE DEPARTMENT OF EDUCATION
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RESEARCH AND DEVELOPMENT IN DATA PROCESSING FOR PUPIL PERSONNEL AND CURRICULAR SERVICES

Cooperative Research Project No. D-050

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California State Department of Education
Sacramento, California
1966

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PREFACE

This is a report of a three-year project on educational information systems; the project was concerned with the development of an automated subsystem in the areas of pupil personnel and curricular services.

Although the general outline of the report is that prescribed by the U. S. Office of Education, one major deviation has been made. Because this project may be of interest to several types of educators--including top administrators, operational guidance and curriculum specialists, and educational data processing technicians--one main portion, Appendix A, has been written at three levels, of specificity so that persons who desire only an overview of the operational system can get it by reading the "summary section"; those who wish a detailed presentation can find it in the "guide to the system"; and those who wish to learn about the operation of the system can read the final, step-by-step technical presentation.

In a similar fashion, Appendix G contains a description of the regional center concept, an organizational and operational framework used to implement the system in California.

Valuable advice and assistance regarding the project were given by the following groups and individuals: the California State Advisory Committee on Integrated Data Processing; J. Graham Sullivan, former Associate Superintendent of Public Instruction, California State Department of Education, and Richard Clowes, his predecessor; William H. McCreary, Chief of the Bureau of Pupil Personnel Services; William E. Behnk and R. Jack Totheroh, directors of the first Regional Centers; all of the persons listed in Appendix B, and those who worked with the staff in an ex officio capacity; and all of the associations and organizations that provided the encouragement and support that facilitated the completion of the project.

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RESEARCH PROJECT

The California State Department of Education proposed to develop and demonstrate through the use of an electronic computer an effective education information system with special emphasis given to the areas of pupil personnel services and curriculum. The emphasis was on the end products created, not on the tools needed to create them. Too many educators have become too much concerned with data processing tools and too little concerned with the information product.

The need for the project was evidenced by the fact that although school districts across the nation were rapidly moving into the use of educational data processing services, no single agency in the nation could provide substantial assistance in developing the services or consultation to school districts and state departments of education regarding what services were needed and how those needed might be developed, and no single agency was financed to develop, study, and recommend methods of processing educational data that might be used to best advantage.

The rapid increase in school enrollments during the last decade has created serious problems in processing pupil data. For each of the millions of pupils in the high schools, literally hundreds of pieces of essential data are generated, processed, recorded, copied, reprocessed, filed, evaluated, collated, and indexed. The use of data processing equipment has made it possible to gather information once considered too expensive to collect but that has great value especially for use in planning and evaluating instruction, curriculum studies, guidance, counseling, and other ancillary processes. As the school population grows and greater need develops for educational data, the problem of processing pupil data and securing and processing the data needed in conducting the educational program becomes increasingly great.

The use of data processing equipment, including high speed electronic computers, is causing major changes in the structural relationship among educational agencies which consume vast amounts of data and making advances possible that were out of the question before data processing equipment was used.

The California State Department of Education, through its Bureau of Pupil Personnel Services, concluded in 1963 a cooperative three-year research project involving educational uses of data processing equipment in the Richmond Unified School District. The study was prompted by the major problems described and by the necessity of relieving professional guidance workers of the increasing burden of clerical work involved in handling pupil personnel data.

STATE ADVISORY COMMITTEE ON INTEGRATED DATA PROCESSING

The Department previously had formed a state advisory committee to study the possibility of developing data processing procedures that might be adapted for statewide use in California high schools (Appendix G). The Committee was charged with the following responsibilities:

- Studying current operations involved in the processing of pupil personnel data in an attempt to define the effectiveness, efficiency, and costs of such operations

- Determining whether data processing equipment and procedures could or could not improve the efficiency and reduce the costs of processing pupil personnel data

- Establishing a pilot data processing center to test procedures and theories in an operational setting

- Determining the feasibility of California high schools employing an integrated data processing system for pupil data

- Establishing a research and development center for the purpose of continued research and appraisal in data processing

To secure competent technical assistance for the study, the State Department of Education contracted for the services of the System Development Corporation, which assigned two persons to work with the Committee.

The Committee initiated its work through a study of modern electronic data processing machines. Next it began to develop methods for collecting information on existing data processing procedures and related counselor functions. The initial report of the State Advisory Committee on Integrated Data Processing was published by the Department of Education as "A Report of a Study--Processing Pupil Personnel Data."

RICHMOND PILOT PROJECT

As a result of the study, it was recommended that a pilot project be established for a three-year period beginning in the fall of 1960 in the Richmond Unified School District. In this project punched card equipment was used for the following purposes:

- To develop forms of machine programs that would provide the greatest flexibility and provide for uniformity of student records

- To prepare reports of desirable practices and illustrations of machine programs and procedures

- To determine the feasibility of establishing regional data processing centers

- To explore promising uses of data processing equipment in education
- To develop inservice seminars designed to familiarize educators with data processing on a conceptual level
- To serve as a consultant center to any school district interested in initiating data processing or solving data processing problems

The project began operations in August, 1960, and served 25 schools in five school districts in five separate counties. The report of this work was published as *A Report of an Experiment--the State Pilot Project in Educational Data Processing.*

RESEARCH AND DEVELOPMENT CENTER

In the original documents reporting the work, views, and plans of the Advisory Committee to the Bureau of Pupil Personnel Services, the possibility of extending the types of services provided by the Richmond pilot project throughout the state, or facilitating their local development, was discussed. The Committee recommended that, as major support for local centers and as a stimulus for improving the effectiveness of all such systems, a common center for development in data processing as applied to pupil personnel and curricular services be established. The Committee recommended that this center be established in the State Department of Education. Consequently, the Research and Development Center in Educational Data Processing was established to expand and refine the work initiated in the pilot project and convert its applications to an integrated system utilizing a computer.

Objectives and Hypotheses

The operation of the Research and Development Center was structured to achieve the following major objectives:

Design and development of model systems for collecting and handling data to meet the requirements of pupil personnel and curricular functions, including the analysis of existing systems and a planned transition to more effective systems

Basic to the development of educationally oriented systems is the analysis of the specific requirements of data processing systems. Caution needs to be exercised so that modifications can be made at different levels of local control. The restrictions and conditions under which the new system will operate must be determined in detail and in advance. Most restrictions will be technical in nature, influenced perhaps by equipment considerations, but more important restrictions will be imposed by the legal, financial, psychological, administrative, and scheduling considerations that affect system design. There must be adequate staff orientation to enable educators both to make optimum use of the system potentials and to play their part in the system with understanding and cooperation. At all times, educational objectives and standards must dictate the nature of the processing systems rather than vice versa.

The activities of the Center were focused on development of data processing itself, rather than on studies that would incidentally use data processing as an instrument. There was, in 1962, no agency--outside the laboratories of manufacturers--that focused on this vital area.

The Research and Development Center was charged with developing improved designs for pupil accounting systems already using machine processes, as well as experimenting with systems that had not yet been adapted in any degree to machine data processing. For example, the design of class and pupil schedules and pupil registration would include provisions for eliminating scheduling conflicts of pupils, making possible the maximum use of school facilities, placing teachers in optimum teaching situations, and keeping the necessary records for office and teacher use. The design would be basic to the entire pupil accounting system, since it would tie in closely with the attendance accounting system; report cards; cumulative records; and many varied reports, lists, and statistical studies.

Once the machine system was devised to handle adequately these complex operations, it would be necessary to design expeditious ways of obtaining the source information required to initiate these services.

Development of proposals for cooperative establishment of compatible systems for mutual benefit of local school systems

Each school district has established a pupil accounting system, usually under considerable pressure to get work done, and hence, with little time or encouragement for original and developmental study of the methods themselves. Furthermore, little attention has been given to the need to exchange, collate, and summarize valuable educational information except to meet specific, and often transitory, problems. Thus, a wide variety of systems has evolved, each differing in major ways or minor details from other systems, and there is also wasteful duplication of developmental efforts and expense. Unquestionably, there would be potentially great value to educators if feasible methods could be developed to produce a wide variety of information to meet varying educational requirements at local, regional, state, and national levels.

Research and development in facilitating computer applications by means of programming aids such as compilers and report generators

One of the most serious obstacles to educators' effective use of the proper resources of internally programmed electronic computers is the apparently forbidding problem of learning to prepare programs. In recent years manufacturers and technicians have worked cooperatively to develop programming aids such as assemblers, compilers, and report generators, which considerably facilitate the programmer's task. Compilers, in particular, make use of linguistic, logical, and algebraic forms that may be written in an easily readable style and are easily learned by an inexperienced programmer. Some of these "languages" are also designed to be "machine independent," so that programs written in Bakersfield for machine X can also be used in Sacramento on machine Y. However, like computers themselves, these languages give greater attention to the needs of scientists, engineers, and similar specialists than to the needs of educators. Educators need an educational compiler based on existing computer languages but embodying intrinsic procedures, functions, and routines most often used in educational applications. Again, the Center could sponsor and support the development of such systems by working in conjunction with the technical specialists who develop and compile the languages of manufacturers.

Conduct and support of simulation studies in areas such as data processing (pretrial of new systems) and in specific applications such as scheduling, guidance, validation of counseling procedures, and curriculum changes

It is now quite evident that at least certain types of complex decision processes can be performed or assisted more efficiently by computer systems than by humans. The potential of these new quantitated decision-making techniques appears to be great. Efficient use of data would allow educators to make better decisions, and for the first time, allow them to experiment with techniques of solution before expending funds on untried programs or services.

The Center was structured to experiment with methods of performing decision-making functions on electronic machines, methods that would involve the use of "theoretical models" of the consequences of decisions. These theoretical models could become complex and could require many man-months or even man-years in their development. Through their use, it would thus be possible to explore varieties of solutions to problems involving the analysis of the complex information that affects administrative decisions. Perhaps the most important kind of simulation study would involve pretrial of data processing systems themselves, particularly computer programs prior to their actual installation or use.

Establishment and maintenance of a library and clearinghouse for information relevant to educational data processing methods, systems, and equipment

Some school systems have already prepared manuals describing their procedures, and one could make a sizable collection of different card and tabulating forms, which might provide valuable guidance and inspiration for other districts. There is also a growing literature on data processing applications, which needs to be reviewed, summarized, collated, and made available through a central clearinghouse, since much of this literature is available only in sources not usually consulted by educators or is distributed by manufacturers only to their own customers.

The development of computer programs creates, in a sense, capital items of expense; however, once these programs have been perfected, they may be shared--unlike furniture, buildings, and other capital expenses--with many school districts at little or no cost, thus increasing the efficiency of each district's system and reducing the unit cost of program development. Some agency needs to support programming and then to make the results available to qualified local units upon request.

Evaluation and analysis of available data processing equipment and the development of specifications of required capabilities of new equipment for educational use

Until recently, manufacturers designed equipment for commercial, scientific, and military use but rarely tried to meet the specific and unique needs of educators. Recent and current developments in the technology of data processing make it increasingly difficult for educators who are inexperienced in data processing to obtain from one objective source reliable information about existing equipment and the configurations appropriate for school systems. Collection and analysis of the essential and critical performance characteristics of available equipment could best be performed by an agency such as the Research and Development Center.

As the volume of data processing services increases throughout the country, it will become increasingly important that educators be able to express, with adequate technical understanding and detail, their needs for the modification or creation of equipment. Schools, as potentially large consumers of equipment, should be able to focus manufacturers' attention on the specifics of educational needs. There is already evidence of a strong interest on the part of some manufacturers in obtaining such guiding information from educators. Too often the very nature of school data processing systems has been based upon an assumption that schools must use what exists. If the systems were approached without regard to such limitations, new needs could be discovered and made known to enterprising manufacturers.

Related Research Reviewed

The Henle Project. The Henle Project, a cooperative project of the National Science Foundation and the National Institutes of Health, is planned to devise and test simplified adequate systems of measuring and reporting financial, manpower, facilities, research, and other activities in colleges and universities. A report of this project is being prepared for publication.

Total Information Service (TIS). In developing its Total Information Service, the Chicago Board of Education considered two key elements: (1) efficient data collection and economical data conversion procedures; and (2) the total system approach to data processing. The Board has approached the collection and conversion problem in a way few school districts would consider because of a significant departure from established educational methods as well as from the traditional data processing punch card. TIS will use an electronic optical character reader, a device that reads typewriting from a standard-size (8-1/2" X 11") piece of paper and then converts the data to magnetic tape for computer processing. Data will be prepared in the schools on typewriters with special type fonts, and the central computer will use identical type in preparing "turn-around" documents that can be read by character readers in the schools.

New England Educational Data Systems (NEEDS). Regional cooperation is being demonstrated by the Newton, Massachusetts, Public Schools and the New England School Development Council (NESDEC). NESDEC began NEEDS in

1960 as its data processing project, initially supported by the School and University Program for Research and Development at Harvard University and the recipient, in 1964, of a large grant from the Ford Foundation.

NEEDS' goal is to provide a variety of computerized services to 100 school systems by 1966. In addition to performing the routine activities of scheduling, issuing report cards, keeping attendance records, and scoring tests, the NEEDS program is designed to train school personnel in the educational application of data processing technology. The project also plans to work cooperatively with the several state education departments, colleges, and universities in New England.

The project's major concerns follow:

- To eliminate in school systems the informational bottleneck caused by traditional procedures of record-keeping
- To provide quickly accurate information for the use of state and federal agencies in their planning and financing of education
- To establish effective machinery to relate the educational research of universities to the day-to-day operation of the school system
- To bring technological improvements in information systems within the economic range of the public schools
- To develop a body of personnel with skills in both education and data processing
- To close the gap between the high level of data processing in business and federal agencies and the low level of data processing in schools
- To aid in the revision of state legislation so that the machinery of government will not impede logical and effective change when and where it is indicated
- To develop in public education quality control techniques to promote better school administration

The overriding aim of the program is to expedite the operating machinery in education so as to individualize instruction.

Unlimited Potential Data Through Automation Technology in Education (UPDATE). In 1963, the Iowa Center for Research in School Administration began a project in educational data processing in cooperation with the College of Education, State University of Iowa; the Measurement Research Center, the Iowa State Department of Public Instruction; and six school districts. This project is now administered by the Iowa Education Information Center.

The objective of the program is to provide school districts with an increased capacity to cope with existing intricate and massive data problems and to facilitate educational research through applications of data processing and computer science. Problems in reporting and analyzing pupil personnel data, management data, and financial data will be considered. Research will be facilitated through uniformity and availability of data.

The program is aimed at the general problem of introducing the use of computer systems into Iowa schools for purposes of research, training teachers to use data processing services, and providing school services.

Research. Various data processing procedures are being studied to see which ones can be adapted for the Iowa program. Uniform methods and systems for the state's schools to record information will be worked out so data for all schools will be in the same form for use. Once coding systems have been worked out, it will be possible to study, on a statewide basis, educational problems which could not have been undertaken before because of cost or time factors.

Training teachers to use data processing services. The State University of Iowa plans to offer workshops and courses to train school personnel in the use of data processing.

Providing school services. Services to be developed using electronic data processing include: class registration; class scheduling; automatic class leading; locker assignment; auditorium seat assignment; homeroom sectioning; ability sectioning; report cards; attendance reports; honor and eligibility lists; pupil progress reports; guidance reports; staff certification; teacher assignment; activity fund records; inventory control of textbooks, library materials, and audio-visual equipment; and preparation of budgets, payrolls, requisitions, purchase orders, fiscal reports, and bus schedules. In addition, services which most Iowa school administrators do not now have--including enrollment projections, building utilization analyses, financial projections, and unit cost analyses--could be provided through UPDATE.

The Iowa program is voluntary, and schools may take any number of services for a nonprofit charge.

Palo Alto Project. The Palo Alto (California) City Unified School District's computer center is part of the district's information Services Department. This department is responsible for preparing information necessary for appropriate decisions by school personnel at all levels.

"Information" is viewed in its broadest sense. As a result, the Information Services Department includes the computer center; information on other technologies, such as teaching machines; the group testing program, which is viewed as a form of objective information for all school personnel--curriculum, instruction, and guidance; and several NDEA projects concerned with decision-making. The role of the Information Services Department in Palo Alto is integral to the daily operational aspects and the decision-making procedures of the educational system; it is not viewed as an auxiliary service.

The department is divided into three sections: instructional, production, and development:

Instructional. The instructional section has two responsibilities. The first is to assist the high schools in computer-related curriculums by offering assistance in teaching programming and the use of computers. Students use the computer center as a laboratory. The other responsibility of this section is for inservice training of school district staff in the use of computers.

Production. This section is responsible for producing those services and reports that are part of the ongoing educational process of the school district. They include high school scheduling, report cards, testing, attendance, library catalogs, personnel data, and other services.

Development. This section is responsible for systems analysis, design, and implementation of any new service. This section also is responsible for programming the computer.

Although certainly no one organization is best for the computer sciences within education, the success of the Palo Alto effort thus far would indicate that its approach has been successful in maximizing the use of computers in education.

Cooperative Plan for Guidance and Admission (CPGA). The Cooperative Plan for Guidance and Admission, developed in Georgia, is one solution to a pressing educational problem--organizing, summarizing, and communicating all the information that high schools collect about students. The essential ingredient in such a plan for educational communication is a cooperative effort by educators. Educators must work together and with employers, on at least a statewide basis, toward the following ends:

- Development of a "common language" and a "universal code" to be used by all schools and colleges in the recording and transmitting of information about students
- Application of modern electronic techniques (high-speed computers) for summarizing and communicating information about students
- Evolution of a system for feedback of information to high school administrators so that they can know the success achieved by their graduates in jobs and college
- Reduction of the costs of student record-keeping while improving its efficiency

The CPGA plan uses a standardized set of materials to record the student's entire record, including both curricular and extracurricular activities. When the student completes the eleventh grade, all of the information on his record is manually transcribed to a machine-readable document or transmitted via punched cards. During the summer, his data are processed, printed, and returned to the school on a multiple-part form.

This form presents a detailed report of the student's progress and achievements in a standard format. When a student requests a transcript during his senior year, one copy of the form is manually updated, signed, and mailed to the college or university of his choice. This form also provides space for the college or university to return information and marks to the high school, thus enabling the high school to evaluate its educational program.

CPGA has received support from the Ford Foundation and Educational Testing Service. ETS also has coordinated the processing of CPGA materials through its computer facility during the developmental stages of the plan and now is making available the computer programs and procedures to state education departments and universities desiring use of CPGA.

Project on Program Evaluation and Review Technique (PERT). The Cooperative Research Branch of the U.S. Office of Education has granted funds to Ohio State University to investigate the degree to which PERT can be applied to educational research and development in order to identify in advance those elements that are critical to the success of an educational program.

The specific objectives of the project follow:

- To develop guidelines for applying PERT to a variety of educational research and development projects
- To construct a series of model PERT networks for common and representative types of educational research and development projects
- To apply PERT to specific ongoing projects in order to study the possible improvement in project progress from such application
- To make recommendations regarding the applicability of PERT to educational projects and to disseminate the recommendations to potential project directors through publications, seminars, and workshops

Registration and Scheduling. One of the more mundane and exasperating tasks in education is that of constructing schedules for best utilization of staff and plant, while providing the individual student maximum latitude in the selection of courses. Several computer programs have been written to assist the educator in constructing a master schedule and placing students in classes. Recent developments also are pointing toward the actual computer construction of the master schedule within predetermined and administratively set limits. Thus, EDP is providing the means to implement many new and exciting educational programs.

The Research and Development Center staff has become familiar with many registration and scheduling EDP programs, including MIT's GASP, IBM's CLASS, the University of Pittsburgh's Turkes-Holzman program, the Anderson-Harvard program, the Stanford program, and several others that are designed for specific machines but which generally are modifications of one or more of the preceding programs.

United States Office of Education (USOE) Activities. The U.S. Office of Education is deeply involved in a number of activities that affect EDP projects and procedures. USOE's function is to provide educational leadership and coordination, which include the development of systems and machine procedures.

For a number of years, the USOE has been working with the major national educational associations to come to some agreement on the terminology and items of data needed for educational records and reports. To facilitate and improve the collection, maintenance, and reporting of educational information, USOE had developed a number of handbooks, which will be considered in the proposed Research and Development Center project: Handbook I, *The Common Core of State Educational Information*, published in 1953; Handbook II, *Financial Accounting for Local and State School Systems*, 1957; Handbook III, *Property Accounting for Local and State School Systems*, 1959; Handbook IV, *Staff Accounting for Local and State School Systems*, 1965; and Handbook V, *Pupil Accounting for Local and State School Systems*, 1964. A handbook concerning items of information related to instructional programs is under development. The USOE, with the cooperation of a nationwide group of educators, has also completed the item specifications for a professional personnel data card, the first phase in a Basic Educational Data System (BEDS).

Automated Cataloging Project. The University of Southern California and the Audio-Visual Education Association of California, Southern Section, have recently received a grant from USOE to investigate the uses of automation in the A-V field. The primary areas of investigation include an evaluation of the feasibility of establishing central catalog notation service and the development of input and output procedures to the systems that would utilize computers. The project will also prepare cost comparisons on traditional versus centralized catalog preparation for local users.

Development and Operation Procedures

The Research and Development Center was organized with the staff serving as the coordinating and consolidating force and field committees as sounding boards for innovation and desirable practice.

The names of the field committees and their participating members are listed in Appendix H. The committees were organized and made operational in a period beginning in late 1962 and extending through early 1963. Each of the committees was given specific tasks, and the overall schedule of the project was considered in establishing deadlines for these groups.

Progress of the research and development has been summarized in the quarterly project reports submitted to the U.S. Office of Education. Copies of these reports are included as Appendix B.

An important part of the project's design was the involvement of related groups in the field of education. While the specific concern was in the development of a pupil personnel and curricular data processing system for high schools, it was quite evident that this goal could not be reached without having some impact on related fields. Therefore, such diverse agencies as the California Coordinating Council for Higher Education, the staff of the University of California, the State College Chancellor's staff, the elementary and secondary principals' and superintendents' associations, and several agencies of the California state government were involved. Involving these agencies required a considerable expenditure of time on the part of the project's Director and the Associate Director, but the returns were well worth their efforts. The later progress of the project was considerably facilitated by this early groundwork, and many doors opened because of an understanding of the procedures and goals of the project. This acceptance ultimately will facilitate the development of a system of information for adoption statewide.

The entire operation was continued under the guidance of the State Advisory Committee on Integrated Data Processing. Members of this committee are listed in Appendix G.

The overall procedure followed can be stated as follows:

The research and development center, headquartered in the State Department of Education, used live data from the pilot project at Richmond and from the data processing center serving the Sacramento area.

Data from six major areas of the pupil personnel program were considered:

- Preregistration, programming, registration, and postregistration
- Mark reporting
- Attendance accounting
- Test scoring and reporting
- Cumulative records
- Research and statistics

A complete description of the system developed is contained in Appendix A. The first effort of the Research and Development Center was the refinement of the punched-card procedures and techniques used at the pilot project in Richmond into an integrated electronic data processing system. Once the programs were developed, they were established as a part of a program library available to all school districts in California and other states.

Staff members of the research and development team were assigned to specific projects.

The assignment procedure included the following:

- "Experts in residence" were invited to the Research and Development Center to contribute their particular talents to the problem under consideration.

- Statewide project committees were appointed to work with the staff on assigned problems.

- Associate systems analysts were assigned to each project committee to help with the systems analysis of the problem and then to design a system that incorporated the best design features and integrated with a total systems concept.

- College and university faculty members were assigned to the project committees to direct the work of selected graduate students in related activities.

- Members of the State Advisory Committee on Integrated Data Processing, representing educational institutions, professional organizations, and the data processing field, chaired the various project committees.

- The staff of the Research and Development Center planned, directed, and coordinated the committees' efforts and were responsible for developing the overall systems plan and the necessary programming activities.

- The staff of the Research and Development Center worked with other state agencies in designing a master coding system so that the data could also be used outside the field of education. These activities are described in Appendix E.

Analysis of the Data and Findings

Although no research data were collected by the Research and Development Center Project, the study made resulted in several outcomes that should be considered by any group interested in conducting similar projects. The most important of these outcomes are presented and discussed in the materials that follow:

All segments of the educational community must be apprised of the project and its goals as soon as possible.

In spite of modern communications, it is still possible for several projects aimed at the same goal to be in operation at the same time. To prevent wasteful duplication, efforts must be made to communicate with those who may be pursuing similar goals. It is not always easy to accomplish this, because even the communication within federal agencies is such that it is possible for one branch to fund projects which also have been funded by another branch and information about either of these projects may not be communicated to appropriate persons within the office.

The design and development of a model system for processing pupil personnel and curricular data is possible, practical, and feasible, but need only be done once.

Establishing the requirements for a common data base that would meet the requirements for all levels of education also is practical. Researchers should continue to investigate these areas, keeping in mind the State and Local Handbook Series of the U.S. Office of Education.

Conclusions and Implications

After working with educators throughout California for a period of three years, the staff of the Research and Development Center has concluded that there is considerable support for a plan of reporting data concerning pupils and curriculum that might be adopted for statewide use. Support for the Center's project has been continuous, even though significant disagreements on the method of implementing a plan of the type proposed have been expressed. Selected letters expressing this support are enclosed in Appendix I.

During the 1965 session, the California Legislature passed Senate Bill 1291, introduced by Senator Donald Grunsky at the request of the State Department of Education. This bill (see Appendix C) was the outgrowth of a lengthy discussion of how data systems in California could best be implemented. The legislative committee and various education committees all agreed that the regional center concept offered a most economical way of processing data for schools. A publication detailing the regional center concept is included as Appendix D.

Following are the specific results of the work described in Part 5, Objectives and Hyptheses:

Design and development of model systems for collecting and handling data to meet the requirements of pupil personnel and curricular functions, including the analysis of existing systems and a planned transition to a more effective system

The model system has been designed and implemented for collecting pupil personnel and curricular data. This system is described in detail in Appendix A. The implementation of the system is being carried out in the regional center concept, described in Appendix D.

Development of proposals for cooperative establishment of compatible systems for mutual benefit of school districts

A great part of the time and effort of the Research and Development Center's staff has been devoted to the development of compatible systems for possible statewide use. Although many school districts have developed data applications, few have considered a total system approach to educational data processing. Many have developed their applications without considering similar programs in other districts. Members of the Research and Development Center's staff have traveled the length and breadth of the state, meeting with school district personnel and speaking to the various associations to discuss educational data processing. Their goal has been to prevent--or at least to curtail--the wasteful duplication and, at the same time, to explain the approach to the pupil personnel subsystem. This approach has inspired some educators to join with the project staff to work toward statewide compatibility of data.

Research and development in facilitating computer applications by means of programming aids such as compilers and report generators

The data processing industry has been able to reach preliminary agreement on some machine languages, but direct, across-the-board compatibility at the 100-percent level has not yet been reached. To date, the use of the compiler languages such as COBOL and Fortran can result in a high degree of inter- and intravendor compatibility. The Educational Compiler Committee of data processing experts (see Appendix H) has worked with the Research and Development Center's staff to determine whether an educational compiler is needed. Its recommendation was that COBOL would provide the flexibility needed by the project and should be used to write all programs. The Committee also agreed that an attempt to develop a compiler specifically for education was not feasible in Project D-050 because of the limitations of time, staff, and funds.

Conduct and support of simulation studies in such areas as data processing (pretrial of new systems) and in specific applications, such as scheduling, guidance, validation of counseling procedures, and curriculum changes

Considerable work went into the exploration of the simulator of the potential of education. The Simulation Studies Committee developed an amitious plan for applying these procedures to education. Preliminary work had taken place with System Development Corporation for a cooperative exploration of the overall input of simulation in the educational process. However, none of these plans could be implemented until the basic system had been field tested. The necessity of field testing precluded the completion of this phase of the project. However, within the three-year time schedule, plans were developed to use the "information by exception" approach to the generation of various output reports. This approach will facilitate the use of data by the various educators who currently are operating in an information void.

Establishment and maintenance of a library and clearinghouse for information relevant to educational data processing methods, systems, and equipment

When Project D-050 was submitted to the USOE, no agency performed the function of a library and clearinghouse. Therefore, the project staff attacked the problem of establishing a library clearinghouse as one of its first activities.

During the school year 1962-63, the California Educational Data Processing Association (CEDPA) was formed. A number of its major goals related to the collection and dissemination of information about data processing. The Association requested that the project allow it to assume the responsibility for this task, which was turned over to CEDPA. Not long after--also in 1963--a national group, the Association for Educational Data Systems, was formed. One of its main functions also was stated as dissemination of information about educational data processing. AEDS approached CEDPA and the Research and Development Center, and it was agreed that this function would become a part of AEDS' work. However, neither organization was able to organize and begin operations on a scale necessary to meet the demand of school personnel, nor was the Research and Development Center staffed to handle an operation that was growing so rapidly. Therefore, this function has been explored as an activity that could appropriately be handled by the California State Library. Discussions are under way to determine if the State Library can provide this service to the field.

Evaluation and analysis of available data processing equipment and the development of specifications of required capabilities of new equipment for educational use

Earlier work of the project staff was aimed at developing manufacturers' interest in educational systems and educators' interest in data processing. Some equipment manufacturers became interested in educational applications of data processing when they were convinced, at a meeting called in August, 1963, by the Research and Development Center's staff, that the schools comprise a sizable market. The purpose of the meeting was to inform vendors of the work of the research and development project, share some hardware-oriented findings, and request assistance in the development of a low-cost data transmission and collection device. Results of the meeting were improved communication with vendors and development of a low-cost communications device tailored to the project's specifications. The device, built by Franklin Chiang of International Control Machines, will be field tested during the 1966-67 school year.

In addition, the staff conducted a series of seminars to help school personnel to learn the capabilities of hardware and software. With this knowledge, the personnel can better translate their needs into an operational installation appropriate to their financial capability.

It is evident that additional time and effort must be devoted to orienting top-level educators to the potentials of automated information systems. Without this orientation, progress in the areas described will be limited.

In June, 1965, the research and development staff held a conference to discuss the current status of federal projects and to develop ways to facilitate the sharing of learnings from these projects. The major goal was to improve cooperation and communication among projects to the extent that plans for an information system for nationwide use will be started. A publication summarizing one plan was issued as a result of this meeting (see Appendix F). It is hoped that the U. S. Office of Education will consider the plan advanced in this publication and will work with appropriate agencies to implement it.

Appendix A

SYSTEM OF THE RESEARCH AND DEVELOPMENT CENTER IN EDUCATIONAL DATA PROCESSING

The following Summary of the System can serve as an introduction to the two more detailed presentations of the system for those who are interested. The first, referred to as the Guide to the System, reviews each of the various subsystems in more detail than does the Summary of the System identifying the operations. It provides some discussion of the way in which the operations are done and the way in which the documents are processed, but detailed information is generally omitted. The Guide to the System requires relatively little knowledge about data processing and defines technical terms as they are introduced.

For readers desiring more detailed information on the way in which the system operates, a Description of Operations is given. This description makes cross-references, so that any point discussed can be located in the working papers of the Research and Development Center project. The Description of Operations contains a detailed discussion of the input and output formats, contents, and timing for each of the runs, which taken together provide the basic fabric of the system. The use of data files and some explanation of, and comment upon, the processing of the data needed to produce the various output reports are given in the Description of Operations.

SUMMARY OF THE SYSTEM

The data processing system developed by the Research and Development Center in Educational Data Processing concerns primarily the area of pupil personnel services. The system provides assistance to schools--at both the teaching and administrative levels--in registration and scheduling, attendance, accounting, grade reporting, and test scoring and analysis. These parts of the system are interrelated in such a fashion that the data generated in one part are also used in the other parts in order to reduce the cost of operation.

Features of the System

Teachers and administrators familiar with the traditional ways of handling pupil personnel data will note many differences in the system being implemented by the Research and Development Center.

Many of the handwritten documents are gone. In their place the system substitutes machine-printed documents for the gathering of data and machine-printed documents summarizing the results of processing the data that have been gathered. (Samples of the documents described have been reproduced and appear later in Appendix A.) Thus, in registration and scheduling, for example, a student specifies the courses that he would like to take in the coming term by marking them on a printed sheet. This sheet is 8 1/2 × 11 inches, has a notch in one corner, is printed mostly in red ink on heavy paper, and has a pattern of marks on it unlike any traditionally used. But each of these characteristics contributes to the efficiency of the system.

The teacher's roll book has a new size and shape, and its pages are printed in different colors and in new formats, which allow fewer names per page. Attendance and grades are recorded in a new way on different sheets.

Both the classroom teacher and the counselor are asked to supply accurate data. Mistakes that are obvious to human beings often are not obvious to, or correctable by, computers. Erroneous data usually must be rejected and returned to the teacher or counselor for correction.

Although data from each school are still processed on an individual school basis in the Research and Development Center's system, those responsible for the provision of data that involve two or more schools must meet specified deadlines if the data are to be processed on schedule and the summary produced is to be complete.

Description of the Subsystems

A description of each of the major subsystems--registration and scheduling, attendance accounting, grade reporting, and test scoring and analysis--will help one to understand the operation of the system designed by the Research and Development Center.

In registration and scheduling, the student upon enrollment at a school supplies to the system some basic personal data, such as his name, address, and grade level. The data for new students are included with the data for the other students so that the system will produce a course selection form for each student. After consulting with his counselor, each student marks on the course selection form the courses he wishes to take during the term. The course selection forms for all the students are checked for errors before they are placed in the scheduling operation, in which the data they provide are combined with master schedule data supplied by the school administration in order to produce a master list of courses, conflict lists, course lists, locator cards, and other useful information. After the school administration verifies that the results constitute a good and useful schedule, the system uses the data on the student's schedules to develop a file of student master records.

The registration and scheduling subsystem supplies to the attendance accounting subsystem the basic data about which student is registered at which school, for which course at which time, in which room, and with what teacher. These data must be changed periodically to include students who have entered school, students who have dropped out from school, and changes in students' registrations. Much of this work is done by the attendance accounting subsystem, which maintains the student master file of pupil personnel data.

From these data, the system produces attendance report forms, which are completed by teachers. When these attendance report forms are returned by the schools to the Center, they are used to correct the data in the student master file to show each student's attendance to date for the year and for the school month, and to produce attendance reports, including those required for the California State Department of Education.

Data from the attendance accounting and registration subsystems serve as a basis for the grade reporting subsystem. Data from the student master file are used to prepare for each teacher a document listing all students to whom grades should be assigned at the end of each marking period. These documents are then marked by the teacher and returned by the schools to the processing center, which prepares the student report cards, scholarship reports, and mark analyses. Lists of failures, incompletes, and grade point averages are also prepared. Provision is made to reproduce the data if changes are made in the grades reported. The changed grades are incorporated in the student master file records maintained by the data processing center.

The student master file records maintained and added to by each of the other subsystems are also added to by the test scoring and analysis subsystem. In California, testing of students is required at certain grade levels. Most schools, however, administer tests in addition to those required. Schools request the needed test forms from the Center for whatever tests are to be given. The Research and Development Center identifies the forms by the name of the test, name of the student, and by the name of the school. After students have taken the tests, the schools return the answer sheets or tests to the Center, for scoring. From the scores, the system produces rosters and profiles of the test results for use by the counselors, teachers, and school administrators. In addition, the results of the tests are recorded in the student master file records maintained in the Center. Provision in the system is made for producing the "California Guidance Record," which in convenient form summarizes the information from the attendance accounting, grade reporting, and test scoring and analysis.

Advantages of the System

Among the advantages of the system that are of particular interest to educators are the following:

- Reduction of the clerical work load of the teacher. This is accomplished by providing documents that have already printed on them the repetitive data which the teacher has had to write, such as student's name, course number, period, school's name, and teacher's name.

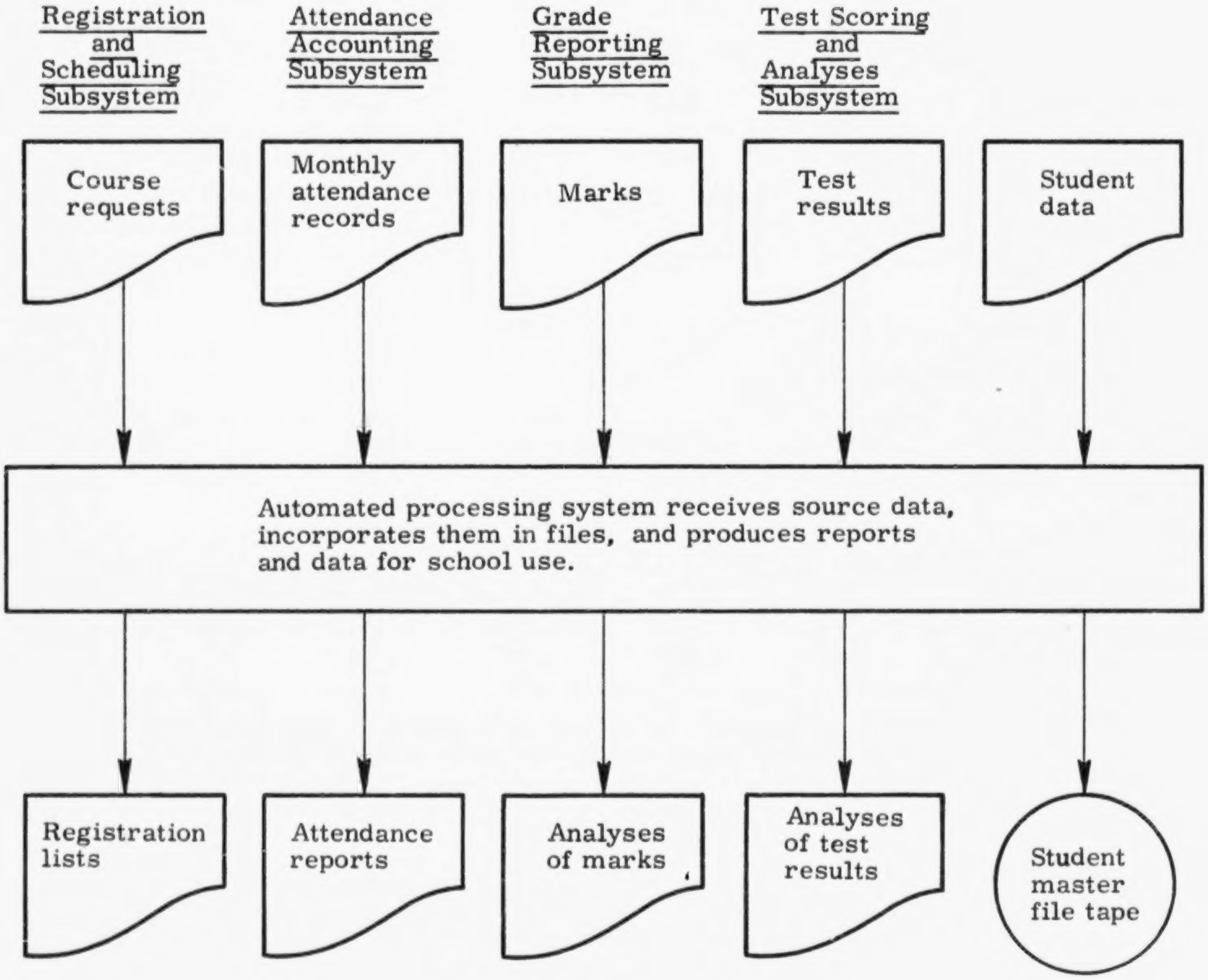
- Reduction of the clerical work load of the administration and staff. This is accomplished by documents commonly used for reference, which the school has had to prepare. Such documents include locator cards, class lists, summaries of grades awarded, attendance reports, and the like.

- Reduction of the cost per pupil for pupil personnel services. This is accomplished partly by reducing the clerical expense involved in maintaining pupil personnel records and partly by improving the usability and the availability of pupil personnel information to counselors, teachers, and administrators, thus allowing them to devote more time to improving pupil personnel services in the schools.

- Provision for interschool compatibility in pupil personnel data processing. This is accomplished by serving a number of schools from one data processing center, referred to as a "regional data processing center." The regional data processing center uses the same system, forms, and procedures for processing the data for all of the students of all of the participating schools. Since the various regional centers contemplated would all follow this basic plan of operation, an educator who has once become accustomed to the forms, procedures, and techniques used in any particular region can transfer to some other region without facing major differences in handling pupil personnel data.

- Implementation of good modern practice. Committees of educators and persons with specialized skills in particular educational areas met, devised, and agreed upon certain essentials in any truly useful pupil personnel data processing system. In implementing the system, the Research and Development Center has attempted to follow as closely as economically possible the recommendations of those committees. The resulting system incorporates many features which represent the best theory and practice in the area of pupil personnel services.

Diagram of System


Registration and Scheduling Subsystem
Attendance Accounting Subsystem
Grade Reporting Subsystem
Test Scoring and Analyses Subsystem
Course requests
Monthly attendance records
Marks
Test results
Student data
Automated processing system receives source data, incorporates them in files, and produces reports and data for school use.
Registration lists
Attendance reports
Analyses of marks
Analyses of test results
Student master file tape

- Transition to an educational intelligence system. The present system is the groundwork upon which more sophisticated and more complete systems can be built. Without this groundwork, these systems would be very difficult to develop.

Disadvantages of the System

The system has the following disadvantages:

- The cost for some local options is increased. For example, if a school should desire to use carbonless paper in eight different colored parts to produce eight copies of report cards--each one 17 22 inches in size--the entire cost of preparing such report cards would probably have to be borne alone by the requesting school. Or if a school desired an additional fifth comment on a report card, the school alone would probably have to bear the additional expense.

- Inaccurate and incomplete data cause havoc. Computers cannot identify what data are missing or which data are inaccurate.

- Operations are dependent upon deadlines for supplying data being met. Timely summaries can be provided only when the required data are available.

- School personnel sometimes feel insecure when they do not do their own data processing. Most teachers and administrators have little time for clerical work, but some of them are of the opinion that they must do certain phases of such work to keep informed regarding all aspects of their assignments. And some school personnel trust only themselves to do a correct job of data processing and are suspicious of a computer's accuracy and completeness of processing.

GUIDE TO THE SYSTEM

In this Guide to the System, which has been developed by the Research and Development Center in Educational Data Processing, attention is given primarily to (1) what the system uses as source data, how they are produced, and what form they take; and (2) what data the system produces, how the data are produced, and what form the data take, especially the data used by teachers, counselors, and administrators. The way in which source data are converted for use in schools is explained to make clear certain reasons the chosen operations, data formats, and documents are used.

The order of presentation in this Guide is the order in which students and teacher will likely encounter major parts of the system. This order is outlined in the accompanying "Diagram of

System." Registration and scheduling are taken up first, then attendance accounting, grade reporting, and finally test scoring and analysis. As will be seen, the data used and produced in any one of these parts of the system also find use in other parts of the system.

In the presentation it has not been assumed that the reader knows data processing techniques. The technical terms used are defined as they are introduced. Readers desiring a more detailed, comprehensive, and technical presentation of the system are referred to the Description of Operations which follows this Guide.

As an aid to following both the Guide to the System and the succeeding Description of Operations, examples of the main documents used in the system are reproduced for observation and study later in Appendix A.

Registration and Scheduling Subsystem

The Research and Development Center project has provided two different ways of starting the registration and scheduling procedure. These two ways reflect historical differences in the types of equipment available to the project and in the kinds of situations which were being met. In practice the ways are more complementary then competitive, although the same result can be achieved in part by each. Both merge into the main flow of data processing work.

The older approach began with a single data collection form. Originally the counselor in the school wrote on this form data about the student to be registered and scheduled. For early test work on the system, this document proved to be adequate, and from it punched cards were produced by a manual transcription operation. These cards contained essentially the same data that the form contained.

With the increase in the number of students being handled and with the availability of improved equipment, the original handwritten form was replaced by the student data form. This form can be used for many purposes. In registration and scheduling, it is used to obtain the student's name, number (if any), sex, date of birth, and grade level. The student indicates his sex, date of birth, and grade level by filling in the appropriate pairs of horizontal lines. If a student number has been assigned, the student indicates it by filling in the boxes on the right side at the top of the columns numbered 0-9. The student prints his name in the small boxes that head the columns, A through 8. He puts one letter in each box and then blackens the corresponding pair of lines in the column below each letter. Because documents are grouped by school as they are sent to the data processing center, school identifying information need not be shown explicitely, but can be added at the time the documents are processed.

The student data forms are read by an optical reader, which follows the guide track printed in black along the right side of the page. The machine uses this track to search for marked pairs of lines on the page, ignoring data printed or written on the page. Then, the optical reader produces punched cards, the holes in the cards corresponding with the marks read on the documents. The punched cards contain all the data marked upon the original form, plus any constant information which may be set in the machine, such as school identification. Once the documents have passed through the reader, further processing is done, not from the data in the document, but from the data punched in the cards produced by the reader.

The cards produced by the optical reader are coded and must be decoded. Decoding is done on the computer as it transcribes some of the data from the cards into a list of names recorded on magnetic tape. Magnetic tape is a storage medium widely used for holding data which consist of a long series of similar items, such as a file of students' names and addresses.

Up to this point, the processing has involved only the handling of information on students to be registered for the first time. Now it becomes necessary to combine these new names with the names of the students who were enrolled in the school the preceding year and are already registered for the present year. These names have been saved on punched cards called "old student transfer cards." These cards are then read by the computer and combined on the magnetic tape with the names of the new students. The list is then sorted into order by student name within the school, and a number is assigned to each student to reflect his position in the list. If the former students have already been assigned numbers, the computer assigns numbers for only the new students.

The computer also produces a course selection form for each student. Course selection forms are what is known as "turn around" documents, because after they are printed by the computer, they are then filled in or completed by human beings and then sent back to be read by the computer. Because they are designed to be read by the optical reader, course selection forms have a particular format.

The student's name, sex, grade, and school are printed in ordinary type on the forms. Printed in the pairs of lines at the far right side of the form in the box with numbers in columns numbered 0-9 is the student number that was generated by the computer. The body of the course selection form is substantially blank except for the four columns of little parallel lines. The reason for this is that offerings of courses may differ by school and perhaps by grade. Therefore, the body of the form is printed to meet the requirements of each school. Each course name is aligned with a pair of lines.

After they are printed, the course selection forms are distributed to the proper school for the students to mark each pair of lines associated with a course they would like to take in the coming term. At the top of the main body of the form is a boxed section of small pairs of lines labeled A, B, C, D, E, F, G, and P. These pairs of lines identify the periods of the school day, from first to last, with P representing the post-school (after school) or before-school period used for choir and other extracurricular activities. Marking any one of these periods has the effect of blocking that period from scheduling by the computer. Blocking allows students to protect parts of their day from assignment of courses, a measure especially useful to students working part time, for example. Once marked, the document is ready to be sent to the data processing center.

In the course selection form, the two alternative registration and scheduling ways meet. Thus far, the discussion has been limited to the older way of generating and handling the data needed to identify the students to be scheduled and registered. An alternative way is available, however, and is described as a part of the attendance accounting operations, since the information needed to indicate which students are returning to the school is available in the attendance accounting records. The counselor, name, and the birthdate, homeroom, and telephone number of each returning student are printed on the form by the computer. The names of new students registered and scheduled are added to the list of names.

Once the completed course selection forms are returned by the school to the data processing center, the first operation is to pass them through the optical reader in order to translate the information marked on the forms into punches in punched course request cards. The optical reader ignores all writing; it reads only the marked pairs of parallel lines. The course selection cards need to be decoded and converted, for speed in later processing, to a list of course data recorded on magnetic tape. In order to maintain accurate school identification, decoding is done only after all the documents for a particular school have been read.

The list of course selections that is written onto the magnetic tape does not include the students' names. For later scheduling operations, however, it is convenient to have students' names recorded rather than coded student numbers. To do this requires replacing each student number with the student name from the student name tape that was generated at the time student numbers were assigned.

In the process of matching the names and numbers, errors in marking the original course selection forms may be detected. For example, some students originally on the list of course data compiled from the forms may be missing because they dropped out, their forms have been misplaced, or they were sick when the course selection forms were filled out. Other students, for whom no document was prepared, now have a document and a number; but if the file has no name to match the number, duplicate numbers may be found. In such cases, an error listing is printed and the data from the corresponding course selection form are referred to the clerical staff for attention and correction. The main result of the matching of course requests with names is obtaining deck of course request cards that identify students and the courses they have requested in a form that can be used by the scheduling run.

The scheduling operation requires information on the master schedule. To this end, administrators at the school prepare a master schedule layout form indicating what courses, rooms, and teachers they wish assigned for particular times of the day. The master schedule is a tabular form designed to be read by human beings, not an optical reader. Data from this form are manually transcribed by key punch operators into data on punched cards, which are referred to as "master schedule cards." The information on these cards is the course number, the time period in coded form, the term identification, the desired and maximum class sizes, the teacher's name and code number, the room number, the course title, and such additional information as may be desired.

The main scheduling run uses the data from the course request card and from the master schedule card to produce a number of lists and reports that are of use to the school and to later operations at the data processing center. The documents for use in the schools are: a list of courses showing their scheduling, a simple course tally, a course conflict matrix, and a course request verification.

The course request verification list can be used, if desired, by the school counselors for checking the original copies of the course selection forms to see that no error occurred in marking them. The course request verification list has data that are not contained on the original course selection forms.

The course conflict matrix or cross tally produced by the scheduling operation is a list of the combinations of courses requested by students. In this matrix, each course is paired with every other course, and the number of students who attempted to enroll in both of the paired courses is shown. The course conflict matrix is very useful to school personnel in improving the original master schedule which they sent to the computer. The information on the course conflict matrix can often be used along with a list of the courses offered to resolve major difficulties in the master schedule.

The course tally produced by the scheduling operation is a count of the number of students who have attempted to register in a particular course. In total, this serves as the equivalent of a condensed master class list for use by the school administration.

The list of courses, also referred to as a "master schedule list," is a complete summary of the results of the scheduling operation. This summary lists the courses in the same order in which they were listed in the original master schedule and shows the count of the numbers of students who were scheduled into each section of each course.

As a result of studying the course conflict matrix, course tally, and list of courses, school administrative personnel may alter the master schedule to achieve a higher percent of students scheduled successfully. If administrators make this study,they can originate master schedule layout forms as corrections to be incorporated into the master schedule. These corrections, after being appropriately sorted, can be used in the data going into the scheduling operation or can be used to modify the information about the scheduling operation that is produced and saved on magnetic tape.

The summary is held on magnetic tape. This summary, which is sometimes called the "schedule tape," essentially recapitulates all the information incorporated in the listings sent to the school but holds it in a form convenient for later processing by the computer. For convenience in later use, the data on the tape are split into two major types of information: (1) information about courses for which individual students have registered; and (2) information about the school master schedule and the number of students enrolled in each course section.

The information on the courses for which individual students have registered can be sorted by student, period, teacher, and school and then listed to produce a temporary record or class list for use in the school. Class lists can be used in the traditional manner.

The student schedule information can be sorted by student number and school for an operation that is vital to the attendance and grade reporting subsystems. This operation is referred to as "updating" the student master file. Updating produces a corrected version of the student master file, showing for each student all the information that was previously available about him, together with the information about his current registration.

In the updating operation, some students listed in the master file will not be registered for the current term because they have moved away, graduated, or left school for other reasons. Data on these is deleted in order that the student master file contain information only on students who are currently enrolled.

Deleted information is usually written on a separate magnetic tape and saved for later reference.

As the student master file is updated, information about the student, his name, address, telephone number, birthdate, sex, grade level, counselor, and courses for which he registered also becomes available. Since this information historically has appeared on locator cards, the computer at this time produces the locator cards for use in the school.

In review, note that updating essentially is the final operation done by the registration and scheduling subsystem. This operation supplies the information needed for successful operation of the grade reporting, attendance accounting, and test scoring and analysis subsystems.

The registration and scheduling subsystem implemented by the Research and Development Center can be used any number of times during the school year. However, it can be bypassed for students who are registered for the first time if the students' schedules are prepared manually and their registration is recorded as a part of the grade reporting subsystem. Registration and scheduling of students may be done each semester (twice each year) or only once each year. Each school is free to use the system to schedule students as it wishes and may use any pattern of scheduling it desires. In other words, the school retains control of all scheduling activities, and the data center works contain the framework outlined by the school to produce the data requested by the school.

Attendance Accounting Subsystems

The heart of the attendance accounting system is the monthly attendance record. To produce the monthly attendance record, the data processing center sorts the student master file by student, period, teacher, and school. This sorted file then serves as the basis for printing the monthly attendance record. At the time that the monthly attendance record is printed, a notation of the page number and the line number of each student's name is made in the student master file. The page and line numbers are used to identify the student when the monthly attendance record forms are returned and processed.

The monthly attendance record serves two major purposes: supplies data to the Center and serves as a record for the school. The right three-quarters of the form is designed for reading by an optical reader--the timing marks along the edge of the page and the little pairs of lines regularly spaced on the page clearly identify it. At the top of the page, the computer prints the page number and the school month in coded form. These enable the computer to identify the data from this document when they are read later. At the top right part of the form, the computer prints the school number in coded form. This, together with the page and month, completely identifies the document when the school returns it to the Center.

The lower right side of the document is ruled into four major parts, and each is subdivided into five columns with 12 groups of 20 rows each. The rows are numbered from 1 to 20, one for each day of the school month. On each row, one student's name is printed at the far left side of the page. The teacher[1] then marks in the small squares under the student's name if the student was ill, not enrolled, or otherwise absent. In addition the teacher may make any other marks desired on the left side of the page. On the right side of the page, there are four major columns, each of which is divided into five columns that are labeled from Monday through Friday. The result is 20 spaces corresponding to the numbers from 1 to 20 in the boxes under the students' names. Since 12 students are listed per page, the usual class requires three pages of the monthly attendance record per school month. The teacher enters, at his convenience during the school month, the attendance status for each student by marking illness, absence, or not enrolled in the spaces provided. If the student is present, the teacher marks nothing on the right part of the form.

The monthly attendance record has perforations separating the left portion from the remainder of the form. Only the right portion is returned to the data processing center. The left-hand portion is retained by the teacher or the school as an attendance record. Since 12 students are listed per page, the usual class requires three pages of the monthly attendance record per school month.

At the end of each month, the school collects from the teacher the right portions of the marked monthly attendance record pages and transmits them to the data processing center for attendance accounting purposes. First the pages are read by the optical reader to reproduce the information on punched cards. These cards, because they are coded, must then be decoded and the information rewritten into a more convenient form on magnetic tape.

Once the data on attendance have been put on magnetic tape, they can be sorted by line, page, and school to produce attendance reports. The first step of preparing these reports is to update the student master file data with information about the attendance for the school month. Updating requires that the student master file also be sorted by line, page, and school to match the information available on the attendance records. Once both files are in the same order, the student master file can be updated to show the attendance, and a magnetic tape can be written showing in condensed form the attendance data for the school, grade level, and students.

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[1] *Teacher or clerk, depending on the school; decentralized elementary school attendance would be marked by the teacher, while centralized secondary school would be marked by a clerk.*

The second tape, sometimes referred to as a "calendar tape," can be sorted again by school; and from it the attendance reports can be prepared. The major attendance report is the attendance register, which supplies the data required by the state of California for state aid. The attendance register is used at the school and district levels. It can be run either to show individual students' names and their attendance or to show class totals of students by sex, grade, school, and district. Typically, the attendance register shows all students' names, with totals by grade and school.

For students having four or more absences during a school month, an irregular attendance analysis report is run, identifying individual students and supplying counts of their absences, the pattern of their absences, and--when available--information about their scholastic achievement. This report is used primarily in the school.

The cycle of producing attendance forms and from them producing regular and irregular attendance reports appears to be a closed system, and during most of the school year it does operate in that fashion. However, a complicating factor is the continual turnover of students within the school and within classrooms. This turnover requires periodic revision of the attendance record that is sent to the schools each school month to reflect the current enrollment in classes. Revising the attendance record requires periodic updating of the student master file to reflect the current composition of the class.

Students dropped from a class are no problem to the data processing system. The system accounts for them in the course change procedure that is part of the grade reporting subsystem. Students added to a class are handled in the same fashion, provided they are not newly enrolled students. Students who are newly enrolled require a separate procedure, which represents a condensed registration and scheduling operation. The actual registration and scheduling of new students is done manually, but their introduction into the student master file, in order to carry them on the attendance record form, is handled as the part of the attendance accounting subsystem.

For new students, a student data transmittal form is used which makes it possible to gather much of the information that will be needed to build the records in the student master file. Such items of information as the student's name, address, previous school attended, and his father's and mother's occupations are requested. The data gathered on the student data transmittal form are manually transcribed onto punched cards. As many as ten or as few as three cards per student may be punched, depending upon the requirements.

Once these cards have been punched, they are run through the computer to check them for consistency and completeness. To make this accuracy check, the computer attempts to construct a master file on each new student from the data on the cards. If the computer detects possible errors, it produces a written list of them for manual follow-up and correction by the schools. This list follows essentially the format of the student data transmittal form.

After the punched cards pass the accuracy check, their data are written on a magnetic tape in the format required in the student master file. These magnetic tape records are then sorted by student number within school. The student master file is also sorted into the same sequence and then run through the computer, together with the magnetic tape carrying data about the new students, to produce an updated student master file. In this process, the new students are added to the student master file. Occasional errors are detected in the process and are listed for follow-up and correction by the school.

The attendance accounting subsystem consists of the procedures established for gathering attendance data and the procedures established for adding new students to the student master file. Changes of courses and of students from one course to another are handled as part of the grade reporting subsystem.

Grade Reporting Subsystem

The grade reporting subsystem implemented by the Research and Development Center in Educational Data Processing involves the use of a machine-readable means to gather information on the grades. From this information the computer produces a variety of reports. Since the data used in the grade reporting subsystem originate primarily in the attendance accounting and registration and scheduling subsystems, an appropriate starting point for following the grade reporting system is the master schedule in the registration and scheduling subsystem.

Data from the school master schedule tape, which contains information about the courses, rooms, and teachers for each school, are combined with data drawn from the student master file. A condensed version of the student master file, listing only the courses for which grades are needed, is used to save processing time. The data from these two sources, after being sorted into course number and school sequence, can be again combined with data from the school master schedule file to provide in written (noncoded) form the teacher's name and course titles. The resulting information is written on a magnetic tape referred to as the "grade reporting tape." This is then sorted by student name, period, teacher, and school.

The sorted grade reporting tape is then used to produce a grade data sheet. In producing this sheet, which is sent to the schools, the computer calculates and notes on a magnetic tape known as the mark reporting tape, the line, page, and school for each student listed on the grade data sheet.

The grade data sheet has two major parts--one on the right and the other on the left side of the sheet. The part on the left provides for the computer to print at the top the students in a class, the instructor's name, the date, and the page number; and below this information, the names of the students in the class. At the top of the right side of the page, the period, course title, course number, and the instructor's name, and room are printed. Below in the pairs of unmarked lines, the computer prints in coded, machine-readable form the school and course identification.

At the close of a marking period, the teacher enters in the column headed "marks" the grades made by the students. Then, on to the right portion of the page, the teacher blackens, in the space on the same line associated with the student's name, the grade assigned to him in the "mark column." If the student has an incomplete or no grade for the period, the teacher blackens the appropriate pairs of lines. Provision is made on the form for the teacher to note any four of 12 standardized comments. The key to these comments is printed on the report card that is used.

After the grade data sheet has been marked by the teacher and returned by the school, it is read by an optical reader. The result of this reading operation is to convert the data into punched cards. These cards contain in coded form the information that was marked as blackened pairs of lines on the grade data sheet. To be usable, this information must be decoded and converted from punched cards into listing on magnetic tape. This is accomplished by the computer, which then sorts the data by the line, page, and school. Then the sorted data are ready for use in preparing reports.

The first report prepared is referred to as the "scholarship report," which is produced by combining data from two sources: (1) the mark reporting tape, which carries information about the page and line number assigned to particular students on the grade data sheets; and (2) the sorted and decoded mark tape, which contains the information from the grade data sheets returned by the school. When the information is combined, the names of students to be associated with the grades they received can be determined. This list is recorded in two forms: (1) a summary tape, which is used for later listing operations; and (2) a printed scholarship report. The scholarship report shows course title, course number, instructor, and school year and lists the student's name and the grade awarded for each marking period. Comments made by the teacher are printed in the remarks column.

The information retained on magnetic tape, called the "mark reporting tape," is used for producing report cards and the GPA listings. This tape is sorted by teacher and department within the school to produce mark analyses by teacher and by department within the school. The mark analysis form shows the teacher's name, the number of A's, B's, C's, D's and F's awarded by the teacher, the percent each is of all marks, and the grade point average of the class. Data for each class are usually shown. However, the data may be summarized by student, teacher, subject, or department.

The updated mark reporting tape, after being sorted by student, room, and school, is used to produce report cards. The reason for sorting by room number is to save the school from having to sort the report cards into last period or home room order. Report cards show the student's number and name, counselor's name, school's name, and the school year. Report cards also list the grades earned for each course and any comments reported by the teacher. Copies of the report card are provided for the student, the school, and the student's counselor.

While the report cards are being prepared, failures and incompletes are cataloged, and grade point averages are calculated. These are summarized on a magnetic tape from which other reports are run. The grade point average data can be sorted to yield lists in grade point rank order. Lists of failures, incompletes, and grade point averages are normally referred to as the "mark performance classification reports." The form for these reports is used either to list failures and incompletes or to list grade point averages. Provision is made for showing the grade average, the student's name, the counselor's name, and in some instances, the rank of the student in his class.

The updated mark reporting tape, which was produced at the same time the scholarship reports were being listed by the computer, can be used to update the information in the student master file when both are sorted into the same order.

A procedure that has been planned but has not been implemented is to maintain a student history file and print periodically the entire academic history of students. The information from the updated mark tape, which is also used to update the student master file, could be used along with the student master file and the student history file to bring up to date the information in the student history file. The California Guidance Record could be prepared from this file. It is planned that eventually the California Guidance Record will be the major result of the grade reporting subsystem and that this record may eventually supplant traditional report cards.

It is anticipated that, from time to time, teachers will desire to correct mistakes made in assigning grades and to change grades. Provisions for doing this have been made in an informal manner in the grade reporting subsystem. Upon written notice from the schools on a copy of the scholarship report, punched cards can be manually produced by transcribing the needed information. The essential data are those identifying the school, the course number, the student's number, and the grades that should appear in the record.

The cards produced by this operation can then be read by the computer and listed on a magnetic tape to be sorted by student numbers. The mark reporting tape previously produced, at the same time the scholarship reports were prepared, can be sorted also by student numbers, and as a result the data combined with the data from the corrections can be sorted in the same sequence. As a result of processing these corrections, selected records in the original mark report tape can be altered to produce an updated mark reporting tape. This tape is used as a basis for updating the data in the student master file.

At the time the updated mark reporting tape is produced, information is available which can be used to produce gummed labels such as are used by some schools to maintain master records.

The procedure for handling changes in registration is an important phase of the grade reporting subsystem. To facilitate registration changes, the data processing center produces for each school and each student a student course change document. This document is produced as soon as the student master file, showing the students' current registration, has been created. At that time the master file is sorted by school, counselor, and student's name. All student course change documents are then run and sent to the school. At the time these course change documents are run, the page and line number on the document of each student are noted in the student master file.

The student course change document consists of two basic parts. The stub on the left side provides space for listing the names and numbers of three students. The eight possible class periods of the possible student registration are listed as numerals 1-8, but nothing is shown after them. This part on the left side of the form is called the "from" section of the form, because the counselor can use it to show the old registration.

The student course change form comes into use when a student wishes to change any part of his registration. For example, a student reports to his counselor that he wishes to change his registration from a course he is taking in third period to a course that is offered only in sixth period and to retain this registration in the course he has been taking in the sixth period but be assigned to the section that meets in the third period. The counselor writes on the form the titles of the two courses and blackens in periods three and six, the pairs of lines showing numbers of the courses in which the student desires to enroll.

Only the new information is shown on the "to" part of the form. If no entry is made on the form, it is assumed that the student wishes to retain his existing registrations. Thus, whether or not other students listed on the same form desire to change their schedules makes no difference in the handling of any one student's data. The student course change documents are gathered from the counselors and submitted to the data processing center. The only documents sent are those which contain changes in students' registrations.

The student course change documents received in the data processing center are read by the optical reader. This operation results in the production of punched cards that contain the information on the course changes. These cards are in coded form and must be decoded into usable form for later processing.

In order to update the courses shown in the student master file, the student master file also must be sorted into the same page and line number sequence as that used for the course changes. Once this is done, the course changes can be used to correct the information in the student master file on a selected basis. At the time that this correction procedure is taking place, the information needed for grade reporting purposes is available. This information may be recorded on a condensed student master file magnetic tape at this time and used when needed for grade reporting.

Test Scoring and Analysis Subsystem

The test scoring and analysis subsystem implemented by the Research and Development Center in Educational Data Processing operates primarily at present as a service for scoring tests for schools and reporting to the schools the results. The basis of this scoring operation has been the FAST scoring system, which was worked out in part by Charles Wilkes in an earlier project conducted by the California State Department of Education.

The Research and Development Center had planned to provide much more extensive services in test scoring and analysis but for various reasons these plans have not been pushed to completion.

The original plans include the roster of test results and the profile of test results for use by counselors and other school personnel. The major report envisioned as a contribution to the development of a system of educational intelligence is the educational planning report.

A school that desires to give achievement or aptitude tests to some or all of its students can select a battery from among those that the data processing center is prepared to score. Upon receiving notification of the tests desired and of the categories of students to take the tests, the data processing center produces and identifies the test cards on which the students record their test responses and makes them available to the schools.

After the students have marked their responses on the test cards, the cards are returned to the data processing center for scoring and analysis. The marks on the cards are converted to data on magnetic tape. These data are translated into scores, and a roster of test results is printed. The scores are then converted into normalized scores, and the profile of test results is printed. At each of these stages, summary information is put on a magnetic tape, which is used to update the student master file.

The roster of test results, which has not yet been used in the format illustrated, provides a place for the identification of the students, the test being taken, and the scores achieved. Typically, the information provided in the roster of test results is in exactly the same order when it is presented to the school as the test cards were when they were submitted to the data processing center.

The profile of test results, which has not yet been used in the format illustrated, provides the same identifying information that the roster of test results does, but the profile provides a graphic presentation of the stanine and percentile scores achieved on the tests by the student. The profile of test results can also be used to summarize the information about groups of students, such as classes or grade levels. It is intended that the roster and the profile of test results be sent to the attention of the counselor.

The norming done on the tests need not be computed according to the norms supplied by the test publisher but may use local, state, or any other norms desired. Provision is made in the test scoring and analysis subsystem for the development of local norms, although part of this operation has not been used. Also as a by-product of developing local norm data, the test data can be subjected to statistical techniques to yield statistical measures for groups of students. These can serve as a foundation for the educational planning report.

The educational planning report has been planned as a transition from the regular test scoring and analysis, which has been implemented to the first step of educational intelligence system. The basic idea behind this report is the exception principle. The student who should be called to the counselor's attention is the student who is exceptional in his performance--either exceptionally poor or exceptionally good. The students, teachers, the classes, the schools, or the areas of the state that should be called to the attention of the administrative personnel at their respective levels are those that are exceptional. The deviant schools or the deviant students merit the special attention of the administrator.

In the past, a major problem has been to identify accurately and rapidly the students, teachers, classes, schools, or areas that are deviant, and to marshal promptly all the relevant data and present them clearly in one convenient form. The educational planning report will meet this need. The very inclusion of "planning" in its title suggests the importance the report is likely to have for higher-level administrators in assigning to the personnel under their jurisdiction matters that should receive particular attention.

To produce the data presented in the educational planning report requires the routine application of statistical techniques to identify the deviant. For example, the student whose aptitudes are high and whose achievement is low relative to his aptitude scores may be worthy of particular attention. The student whose achievement level is high and whose aptitude level is high, but whose grade point average is only average, may be the student who deserves particular attention. The school district whose students have normal aptitude in mathematics but whose mathematics achievement scores are low may be of particular interest to the county superintendent of schools.

The educational planning report provides space for the identification of the level or type of student which is the subject of the report and provides for information on achievement scores in language, reading and arithmetic; grade point averages in language arts, mathematics, and social science; and aptitude scores, both language and nonlanguage area.

DESCRIPTION OF OPERATIONS

The Description of Operations provided here includes a cross-reference by operation (run) number to the working papers of the Research and Development Center project in order that the reader may, if he desires, follow any point down to the actual computer program to be used.

In providing this cross-reference, two major difficulties have been encountered. For several reasons, the documentation has never been complete and has not been kept current. In some instances, no documentation exists to which to make reference. And the existing documentation sometimes is not of the system as it has been implemented, but as it was at some other time or was thought about, or planned. Not all the operations in the system have been assigned run numbers. For convenience here, all operations lacking identifying numbers in the working papers of the project have been assigned numbers beginning with X. Generally, the documentation on all X-identified operations lacks completeness on more than one point. If the operations were documented to the point of assigning a number, they were usually also documented on a number of other points.

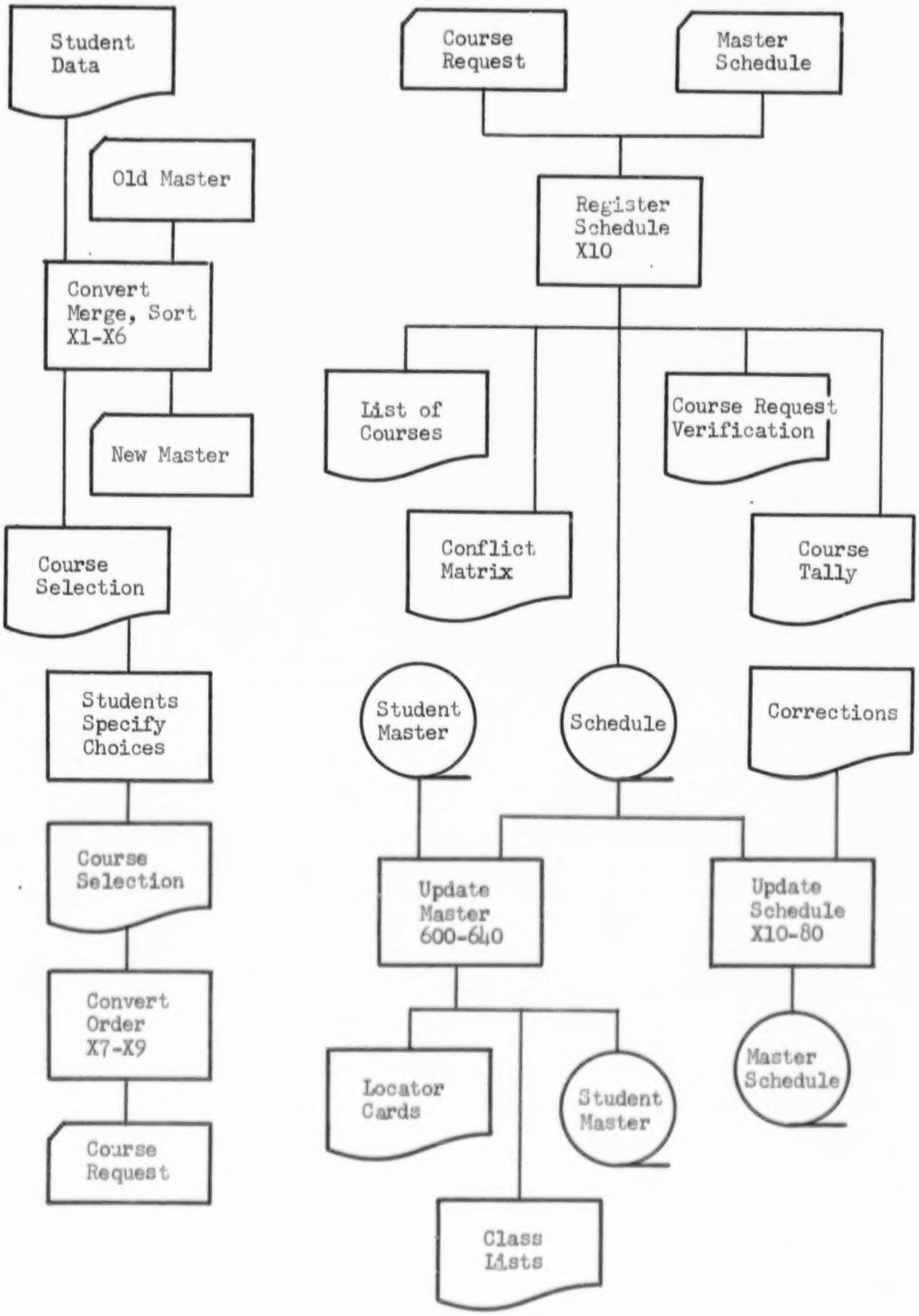
This Description of Operations omits in general any discussion of the handling and identification of errors and exceptions for two reasons: (1) The system itself makes explicit provision for the handling of some common errors such as inadequately marked source documents. When these errors are handled as a separate operation, however, they are covered in this description because they are a part of the regular system rather than a real error or exception. (2) When the working papers of the project do not identify or explain the basis for the identification and handling of errors and exceptions, it has not been possible to provide for the reader a reference to the working papers of the project. In such a case, comment on the handling or identification of errors and exceptions would give an impression of greater completeness to the working papers of the project, and perhaps to the system than, in fact, they possess.

In this Description of Operations the order of presentation follows the normal order of the operations that comprise the system: registration and scheduling subsystem first, followed by the attendance accounting subsystem, then the grade reporting subsystem, and lastly the test scoring and analysis subsystem. This presentation includes specific comment on the input and output as well as a summary of each operation. Following the presentation are detailed layouts for the files handled by the system, and illustrations of the documents that serve as input and output. A summary of some other aspects of the system closes this appendix.

Registration and Scheduling Subsystem

The first registration and scheduling subsystem operations lead up to the main scheduling run XRS-10. Subsequent operations are concerned with maintaining the basic files and preparing data for the other subsystems. All registration and scheduling operations are performed whenever it is necessary to register or schedule students. Commonly, the operation is done immediately before school opens for the fall term. However, the scheduling operation

Summary of Registration and Scheduling Subsystem


Student Data
Old Master
Convert Merge, Sort X1-X6
New Master
Course Selection
Students Specify Choices
Course Selection
Convert Order X7-X9
Course Request
Course Request
Master Schedule
Register Schedule X10
List of Courses
Conflict Matrix
Course Request Verification
Course Tally
Student Master
Schedule
Corrections
Update Master 600-640
Update Schedule X10-80
Locator Cards
Student Master
Class Lists
Master Schedule

is frequently repeated prior to the beginning of each semester and repeated between these times to test possible master schedules for a school.

Operation XRS-1 is an optical reader operation using as input the student data form at the rate of one per student. These forms normally are sorted in school order and are designed for use with an optical reader. The output consists of punched cards in a binary format, one card per student. The sort is the same as the input sort, in school order. The output is used as input for operation XRS-2.

Operation XRS-2 is done on a computer to decode the binary output of operation XRS-1. The output from the operation is a name tape with one record per student, with the students in a school order only. This tape is used as an input for operation XRS-3.

Operation XRS-3 is a computer run, which is commonly referred to as a "card-to-tape operation," even though in practice one of its inputs is the magnetic tape that was the output of operation XRS-2. The other input is a card known as the "old student master record card." These cards report data for students who are returning to school and who need to be registered and scheduled. The sort of these cards is in school order. The output is a name tape referred to as the "new student master record," but this should not be confused with the tape known as the "student master file," which is utilized in later runs. This new student master record tape carries a series of card images, one per student, in the format of the old student master card input. This tape serves as an input for operation XRS-4. Prior to its use in this run, the old student master card deck may undergo a separate operation to reallocate or eliminate those students who anticipated returning to a school but transferred to other schools or dropped out.

Operation XRS-4 is a sort done on the computer. The input is the output from operation XRS-3. The output is identical to the input but is in sorted order by student within school. This output serves as an input for operation XRS-5.

Operation XRS-5 is a computer operation to assign scheduling numbers to students. The input is the output from operation XRS-4. The output of the operation is sometimes called the "all-number" student master record card, although again, this should not be confused with the student master file used later. The output retains the sort order as the input and the same format except that a scheduling number now appears in the format. Typically these scheduling numbers are assigned according to the alphabetic order of the students' surnames, the lowest number being assigned to the student who comes first in the alphabetic sort sequence and the highest number associated with the last student in the alphabetic sort sequence of the input. Space between the numbers makes it possible manually to assign numbers to new students who need to be registered and scheduled after this initial number assignment has been made. The output from this operation serves as input for operation XRS-6.

Operation XRS-6 is a computer operation to print the identifying information on the course selection form. The input used for this operation is the output from operation XRS-5 and cards in an 80-80 format listing the names of schools. This input must be in sorted order by school number, with one input card per school. These cards serve to provide a way of decoding the numerically coded identification of the school name to be printed on the course selection forms. These course selection forms for each school are unique in nature. The actual course titles are printed on the documents after the computer has printed the name of the school. This form serves as input for operation XRS-7.

Operation XRS-7 is an optical reader operation using, as input, the course selection forms which were the output from operation XRS-6 and which have now been marked by the students and school personnel to indicate the courses for which the students desire to register for the next term. The output from the optical reader operation is a deck of punched cards in a binary format. These are in sorted order for each school. This card output serves as input for operation XRS-8.

Operation XRS-8 is a computer operation known as a "course look-up." This operation is made necessary by the fact that all the course selection forms for one school represent that school's unique master schedule of courses. The input, which is received as the output from the operation XRS-7, therefore, has meaning only with respect to the particular school with which it is associated. "Course look-up" requires the binary coded decimal (BCD) course catalog table to be in the same sequence as that of courses listed on the mark reader form and binary punched cards containing course requests in positional form. The binary table created by each course selection form is searched, and when a binary digit is present, the corresponding course identification (ID) is moved from the BCD course table to the output area. The student number is decoded and the BCD representation is moved to the output area. The record is then written on tape, and the operation continues with the next student. A simple tally is kept of the number of students selecting each course. When all students for a school have been processed, the tally is printed and the tape output from the run is used to punch out course request cards and to print course verification listings, since it contains data pertinent to each course selected by a student. The output from the operation is a magnetic tape, in school order, with the records in the format of the course request cards that are needed as later input for the main scheduling operation XRS-10. The output serves as input for operation XRS-9.

Operation XRS-9 is a computer operation that match-merges the file. In this operation students' names are substitutes for the student numbers which were used in order to produce a machine-readable course selection document. To do this requires that the two input files be in the same sorted order. One of the input files is the output from operation XRS-5, which is in order by student within school. The other input file is the output from operation XRS-8, which may be in random order of students within school. If this is the case, an additional sort operation is required to place the file in sorted order by student within schools.

The output from the operation XRS-9 is course request cards in the format needed for input to the main registration and scheduling operation of the XRS-10, plus an optional course request verification listing. One card is produced for each student request. An error list of those students whose names or course requests are not found is prepared in input format on plain paper. This document is sent to the schools to determine whether or not corrective action is needed. It should be noted that the course request card output from this run is identical in format to the first half of the card of the output produced as magnetic tape records from operation XRS-8.

Operation XRS-10 is the main scheduling and registration operation of the subsystem. The other programs incorporated in this subsystem were originated by the staff of the Research and Development Center, but this program was borrowed, modified for use on an IBM 7040, and updated by the staff. The source of the program that serves as a basis for the run was the registration and scheduling program developed by Ernest G. Anderson, who was then at Harvard University for the NEEDS project. The Research and Development Center made certain modifications in the NEEDS program primarily to make it suitable for use on the computer upon which the program was implemented, to change the quantity of course numbers that could be handled, to increase the comprehensiveness of the output, and to improve the sort order in the output. The basic logic of the program was not fundamentally altered in these operations.

The inputs to the operation XRS-10 are the outputs from operations XRS-9 and XRS-11. Both of these are card inputs, one of them being course request cards and the other being the master schedule cards. The outputs obtained from the operation XRS-10 depend upon the operation alternatives taken. The two major ways of running the program are the simulation mode and the output schedule mode. The major output in the simulation mode is a list of those students who could not be scheduled successfully with a detailed indication of the conditions that made it impossible to do so.

The outputs produced from XRS-10 when used on a regular run basis are a master list of courses showing the results for the scheduling operations for each, and a course tally.

The major nonprinted output obtained from operation XRS-10 is the schedule tape. This magnetic tape summarizes the information for student schedules and school schedules.

Operation XRS-11 is a key punch operation to produce as output the master schedule cards. The format for these cards is indicated on the master schedule layout form, sometimes referred to as the "course catalog," which is the input and from which the cards are punched. Normally, one card is produced per course per school. The sort order of the cards, which is important for later scheduling operation, is normally set by human beings in such a fashion that those with only one section are placed first in the deck and for each school are kept separate. These cards serve as input for operation XRS-10.

Operation RS-600 is a computer operation serving primarily to reformat and to break into two parts the output tape produced by operation XRS-10. The outputs produced from this operation are a student schedule tape and a school master schedule tape. Normally one record appears for each student in the student schedule tape, and one record appears for each course section in the school master schedule tape. The student schedule tape serves as input for operation RS-610 and RS-630. The school master schedule tape serves as input for operation MS-80.

Operation RS-610 is a computer sort operation using as input one output from operation RS-600, the student scheduling tape. The output produced is identical in format to the input, but the sort order is by period within teacher within school. This output is used as an input for operation RS-620.

Operation RS-620 is a computer print operation in which the input is from the output of operation RS-610. The output of operation RS-620 is printed class lists which are sent to the school for reference use. The class lists are not used for attendance accounting or grade reporting.

Operation RS-630 is a computer sort operation. The input for this operation is one output from operation RS-600, the student schedule tape. The output is identical to the input but is in sorted order by student within school.

Operation RS-640 is a computer update operation, which uses the information from the student schedule tape to update information in the student master file. The inputs for this operation are from operation RS-630 and the student master file tape. Normally the student master file tape is obtained from the attendance accounting subsystem, but if it is not available from this system, the tape may be obtained from any source from which it is available. If it is not in the sort order of student within school, then it must be sorted before operation RS-640 can be run.

Operation RS-640 has three outputs: (1) The updated student master file on magnetic tape in the input sort sequence, with one record per student which serves as input for operations in the attendance accounting and grade reporting subsystem. (2) A magnetic tape listing, in student master file format, those students who are not currently registered for any course but whose names did appear in the master file. At the present stage of implementation, this magnetic tape is held on file since it is not being used in other operations. (3) A printed locator card for each student. These cards which are sent to the school are produced at this time because all the information needed for them is available when this run is made and no other printed output is being produced by the run.

Operation XMS-10 is a key punch operation, which uses as input whatever has been requested by the school for which the run is being made. Usually the input is marked copy of the master schedule list or of the master schedule cards, the output of operation XRS-11. In either case the output from operation XMS-10 is cards, in the format of the output of operation XRM-11, which can serve as corrections to the school's original master schedule. Usually one card is produced for each correction desired by the school. These cards serve as input for operation MS-60. The reason for this operation is to make possible revision or correction of the master schedule as necessary to reflect changes in school resources and enrollment.

Operation MS-60 is a computer operation to convert to tape information on the cards produced by XMS-10. These records are in the same format as those on school master schedule which is one of the outputs of run RS-600. The output is used an input for operation MS-70.

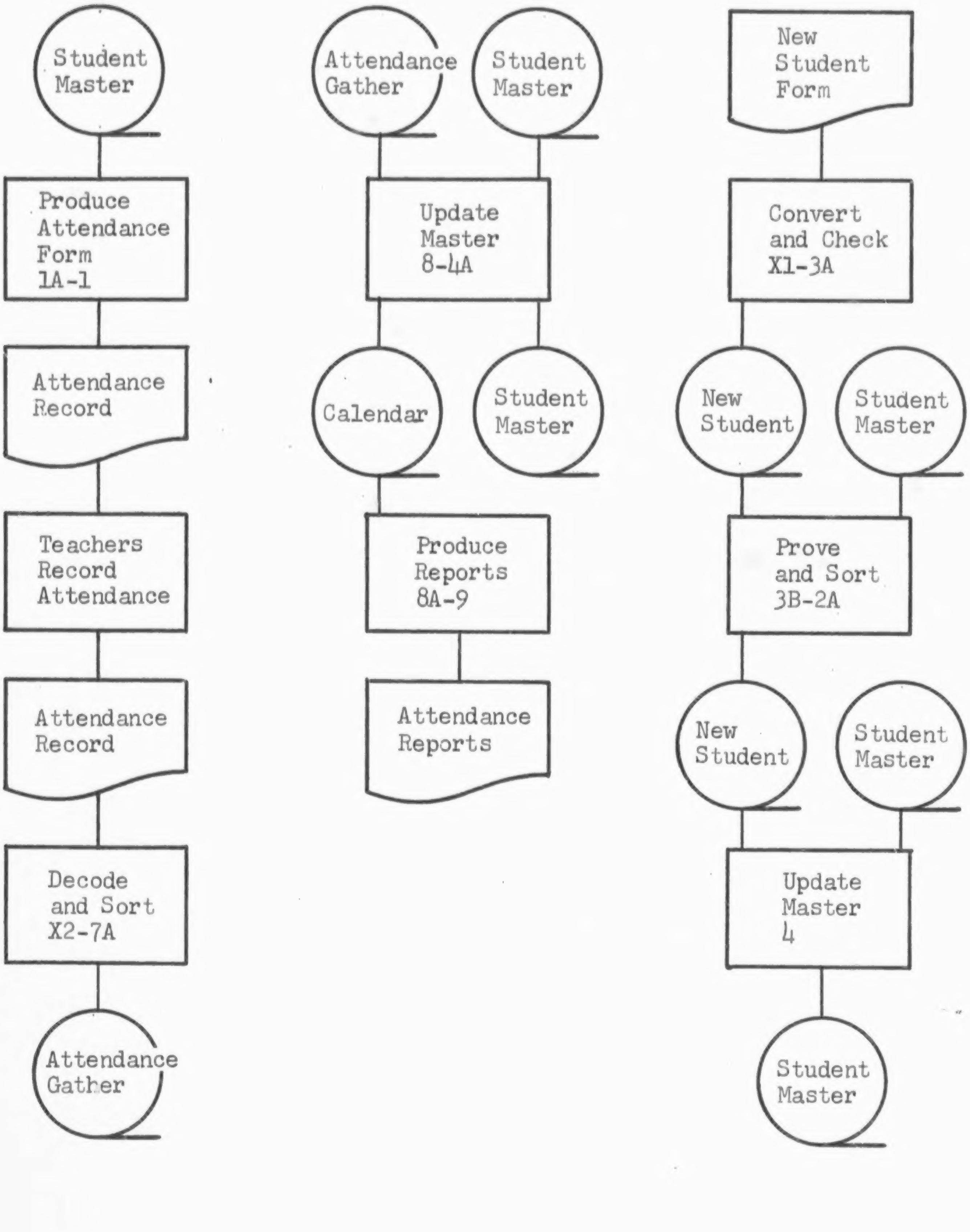
Operation MS-70 is a computer operation to sort the output from operation MS-60 by course number within school. The output of this operation serves as input for operation MS-80.

Operation MS-80 is a computer operation which updates the master schedule used by the school during the school year. The two inputs are the output from operation MS-70 and the master schedule from operation RS-600. The one output from the operation is an updated version of the school master schedule tape which is identical in format to the input master schedule tape. This tape may be used as input operations GR-200 and GR-220 as well as MS-80.

Attendance Accounting Subsystem

The focal point of the attendance accounting subsystem is the preparation and processing of the monthly attendance record form for gathering attendance data. The major output of the subsystem

Summary of Attendance Accounting Subsystem


Student Master
Produce Attendance Form 1A-1
Attendance Record
Teachers Record Attendance
Attendance Record
Decode and Sort X2-7A
Attendance Gather
Attendance Gather
Student Master
Update Master 8-4A
Calendar
Student Master
Produce Reports 8A-9
Attendance Reports
New Student Form
Convert and Check X1-3A
New Student
Student Master
Prove and Sort 3B-2A
New Student
Student Master
Update Master 4
Student Master

is the attendance register. Operations AA-1A through AA-9 normally are performed once each school month. The other operations normally are performed on an irregular basis to reflect changes in the student population of the school.

Operation AA-1A is a computer sort operation. The input is the student master file tape, which may be in any order. Usually this input comes from operation AA-4 but may come from operation RS-640 or AA-8 or from some part of the grade reporting subsystem. The output of the operation is the student master file tape sorted by student within school. This file has one record per student. The sorted master file serves as input for operation AA-1.

Operation AA-1 is a computer operation to produce the monthly attendance record and at the same time to update the student master file. The input to the operation is the output from operation AA-1A. The output is in the same format as the input except for one field change. When the monthly attendance record is returned from the school, it will be read by an optical reader. The optical reader is able to read the school number and the page number, but is not able to identify students. Therefore, to provide a cross-reference at the time the monthly attendance record is produced, the position of each and every student listed on the monthly attendance record is noted in the respective student master file. This makes it possible later to utilize the data read from the monthly attendance record and locate the students to whom those data apply. The other output produced by the operation, the monthly attendance record forms are sent to the school. Upon return, they serve as input to operation XA-2.

Operation XA-2 is an optical reader operation, using as input the monthly attendance record forms returned from the school. The record forms have been marked by the teacher with the attendance data for the individual student. The output from the operation are cards carrying in code the information that was on the monthly attendance record forms. These coded cards serve as input for operation AA-7.

Operation AA-7 is a computer operation to decode and transfer the information that was obtained in coded form as an output from operation XA-2. The output of operation AA-7 is a magnetic tape referred to as the "attendance gathering tape" with one record produced per student. This output serves as input for operation AA-8.

Operation AA-4A is a computer sort operation, using as input the student master file tape, which was the output from operation AA-1. The input is identical to the output, except that the sort order is now by line number within page within school. This output serves as input for operation AA-8.

Operation AA-7A is a computer sort operation, using as input the attendance gather tape produced as the output of operation AA-7. The output of this operation is identical to the input, but it is sorted by line number within page within school.

Operation AA-8 is a computer updating operation done on the student master file to reflect the attendance for the prior school month. The inputs are the outputs from operations AA-4A and AA-7A, which are respectively the student master file tape and the attendance gathering tape. The outputs are the updated student master file tape, which now has in it the attendance data for the prior school month and the attendance for the year to date, and a magnetic tape referred to as the "calendar tape." This tape includes records, in several formats, which are used later in preparing the attendance report and which immediately serve as input for operation attendance only once per school day.

Operation AA-8A is a computer sort operation. The input is the calendar tape that was the output from operation AA-8. The output is identical to the input in format, but the records are reordered on the tape for convenience in operation AA-9 for which this output serves as input.

Operation AA-9 is a computer print operation to produce the attendance reports. The input to this operation is the calendar tape, the output of operation AA-8A. The major output from operation AA-9 is the attendance register. The attendance register can be produced at several different levels of detail, depending upon the use for which the report is intended. In any case, the report is sent to the school for processing. The other output is the irregular attendance analysis report, which is a printed document. This is used for students whose attendance appears to warrant investigation and is sent to the school for processing.

Operation XA-1 is a key punch operation that initiates the procedure used for adding students to the master file when they enter school either at the time of the registration and scheduling or any time during the school year. As such it provides an alternative way of initiating the introduction of a student into the system and even his registration and scheduling. The input for the operation is the student data transmittal form. Normally one form is prepared for each new student, but as many as ten different cards are produced from this document and from associated documents by the key punch operation. These output cards are identified respectively as A through F and 1 through 5. These cards serve as input for operation AA-3A.

Operation AA-3A is a card-to-tape computer operation which attempts to build a master file record from the output of operation XA-1. For those students whose information appears to be incomplete or inconsistent, the computer lists in input format the entire information on the student. This information is then printed and sent to the school for correction. The other output is a magnetic tape in student master file format produced with one record per new student. The order of the records is only by school. This tape, known as the "card-to-tape tape," serves as input for operation AA-3B.

Operation AA-3B is a computer sort operation using as output from operation AA-3A. The sort is by student number. The output is identical in format to the input but is in student number sequence within school. This output serves as input for operation AA-4.

Operation AA-2A is a computer sort operation using as input the student master file. This may come from a variety of sources, such as operations AA-8 or RS-640 or some operations within the grade reporting system. Since operation AA-2A is a sort operation, there is no restriction upon the sequence of the student master file at the time it serves as input. The output from the operation is the student master file, sorted by student number within school. This output serves as input for operation AA-4.

Operation AA-2A is a computer sort operation using as input the student master file. This may come from a variety of sources, such as operations AA-8 or RS-640 or some operations within the grade reporting system. Since operation AA-2A is a sort operation, there is no restriction upon the sequence of the student master file at the time it serves as input. The output from the operation is the student master file, sorted by student number within school. This output serves as input for operation AA4.

Operation AA-4 updates the student master file by inserting the records of the new students. The two inputs are the outputs of operation AA-2A, the sorted student master file, and operation AA-3B, the card-to-tape tape carrying information on new students in the master file format. The output produced by the operation is an updated version of the student master file containing the new students in their proper positions in the file. This tape generally then serves as input for operation AA-1A, but may be used anywhere in the attendance accounting or grade reporting subsystems. The other output produced by operation AA-4 is an error listing showing, in input format, those records which appear to be incorrect. This list is sent to the school for correction. Normally the number of errors identified at this time is very small because of the previous error-checking in operation AA-3A. The major source of errors at this time is a duplicate assignment of student names or numbers.

Grade Reporting Subsystem

The usual frequency of the operations in the grade reporting subsystem is once per marking period. However, the grade reporting subsystem is independent of the number of marking periods elected by participating schools but can accommodate any number of marking periods.

Operation GR-200 is a computer operation that builds a grade reporting tape for eventual use in preparing the grade data sheet. The input to the operation is the condensed student master file tape produced as an output of operation GR-190. The other input is the school master schedule tape obtained from the registration and scheduling subsystem, usually from operation MS-80. The output is a preliminary version of the grade reporting tape. This tape is in student number sequence within school, and serves as input for operation GR-210.

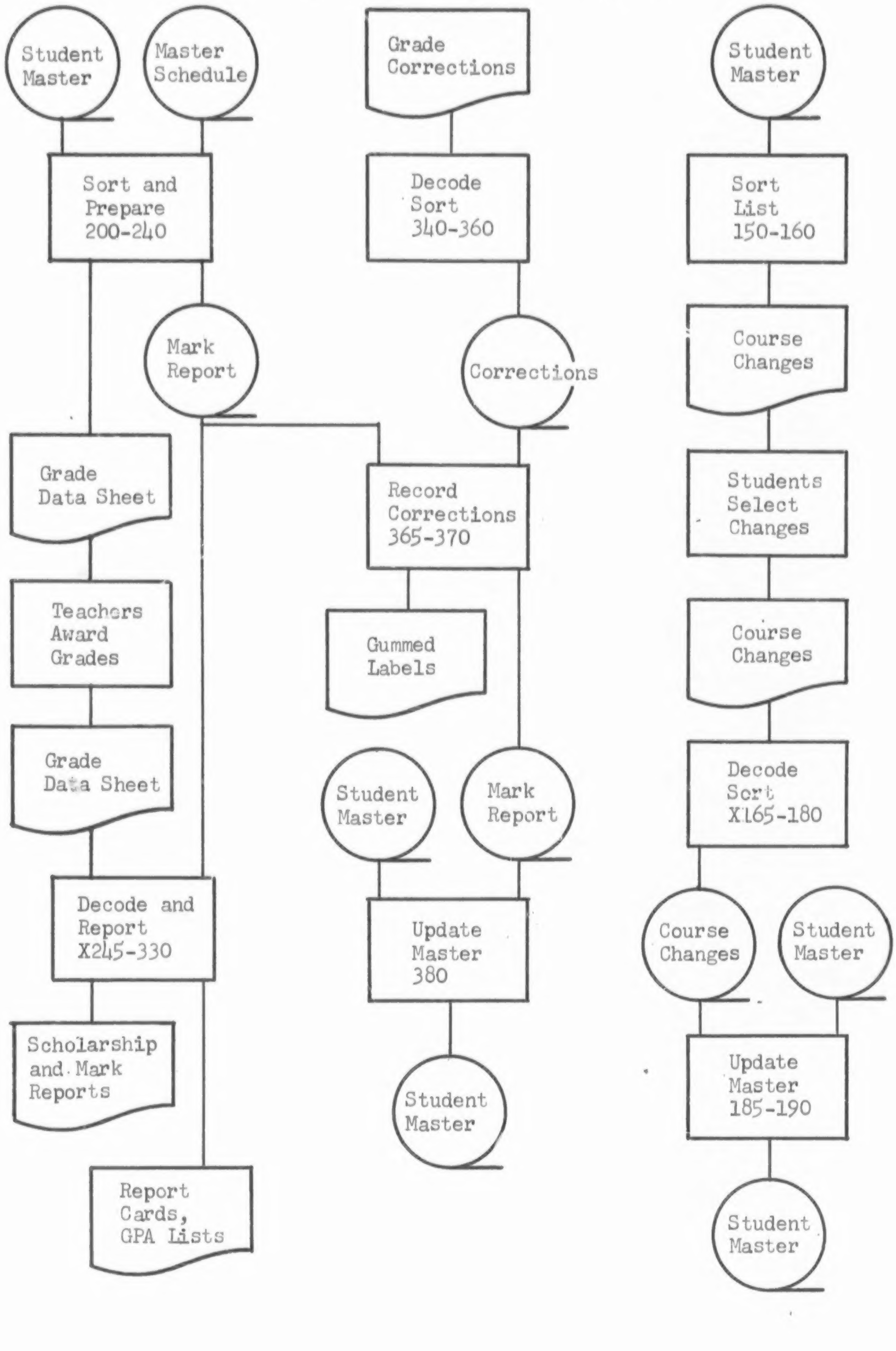
Operation GR-210 is a computer sort operation using as input the output from operation GR-200. The output of the operation is identical in format to the input but is sorted by course number within school. It is used as input for operation GR-220. The reason for making this sort is that grade data need to be accumulated on each student for each of the possible eight courses for which he is registered. In order to avoid repetitive processing of the student master file, which is relatively lengthy, the condensed student master file is used. It summarizes as input for the preceding operation GR-200 only the relevant information needed for grade reporting. In order to be able to use this information in a convenient form, it is necessary to break apart this information to form one list that can be processed once without passing the file eight times.

Operation GR-220 is a computer operation that again uses as input the school master schedule tape, which was also used as input for operation GR-200. The other input is the output of operation GR-210. The output of the operation is the grade reporting tape, which now includes information on period, course title, and teacher name. This tape serves as the form for operation GR-230.

Operation GR-230 is a computer sort. The input is the grade reporting tape that was the output of the operation GR-220. The output is identical to the input but is sorted by student name within period, within course, within teacher, within school. The output serves as input for operation GR-230.

Operation GR-240 is a computer print operation, which produces the grade data sheet. The input is the output from operation GR-230. One output is the mark reporting tape, which is in the same in format as the grade reporting tape but has added the page

Summary of Grade Reporting Subsystem


Student Master
Master Schedule
Sort and Prepare 200-240
Mark Report
Grade Data Sheet
Teachers Award Grades
Grade Data Sheet
Decode and Report X245-330
Scholarship and Mark Reports
Report Cards, GPA Lists
Grade Corrections
Decode Sort 340-360
Corrections
Record Corrections 365-370
Gummed Labels
Student Master
Mark Report
Update Master 380
Student Master
Student Master
Sort List 150-160
Course Changes
Students Select Changes
Course Changes
Decode Sort X165-180
Course Changes
Student Master
Update Master 185-190
Student Master

and line number for each student in each course. This tape serves as input for operation GR-270. The printed output is the grade data sheet, which is produced with 36 students per page. This sheet is sent to the school, where it is completed by the teacher and returned to the data processing center.

Operation XGR-245 is an optical reader operation. The input is the grade data sheet that is returned by the school bearing the assigned marks. The output is in the form of punched cards in a binary pattern. These cards serve as input for operation GR-250.

Operation GR-250 is a computer decode and convert-to-tape operation. The input is the output from operation XGR-245. The output is a magnetic tape referred to as the "decoded" mark reporting tape. This tape serves as input for operation GR-260.

Operation GR-260 is a computer sort operation, using as input the tape output of operation GR-250. The output is identical in format to the input but is sorted by page and line number order within school. The output serves as input for operation GR-270.

Operation GR-270 is a computer update operation. The two inputs, which are both in the same sort order, are the tape output from operation GR-260 and the tape output from operation GR-240. The latter, the mark reporting tape, is the tape that is being updated. One output is a summary tape, which can be used as input for operation GR-280. The format of this tape is a series of print line images needed for that printing operation. The second output, the updated mark reporting tape, is identical in format to the input coming through from operation GR-240 but includes the marks and comments codes obtained from the other input tape. The updated mark reporting tape serves as input for operation GR-300. The printed output from this operation is known as the "scholarship report." This lists the student names and the marks awarded, with any comments, and is produced in input order, matching essentially the order of the names as they were originally printed on the grade data sheets.

Operation GR-280 uses as input the summary tape that is an output from operation GR-270. This operation is primarily a listing operation but also includes sort and summarize elements. The input tape, when listed without sorting, gives a mark analysis by teacher. After being sorted by department, it can be used to provide a mark analysis report by department. Both of these outputs are printed on a mark analysis form and are sent to the school.

Operation GR-300 is a computer sort operation. The input is the updated mark reporting tape that was an output from operation GR-270. The output is identical in format to the input but is sorted by student name within room within school. This tape serves as an input for operation GR-310.

Operation GR-310 is a computer print operation, which produces the report cards and the tape needed for grade point average lists. The input for the operation is the sorted mark reporting tape that is the output for operation GR-300. The magnetic tape output is known as the "F&I-GPA" tape, which contains data on the failures and incompletes and the information needed for grade point average lists. This tape serves as an input for operation GR-320. The printed output from this operation is the report card. The report cards are produced in the order in which they are to be handed out in school, which was the reason for operation GR-300.

Operation GR-320 is a computer sort operation using as input the F&I-GPA tape, which is an output from operation GR-310. The output is identical to the input in format but is sorted on the first 43 characters of the records. The magnetic tape output is identical in format to the input but is in sorted order. This output serves as input for operation GR-330.

Operation GR-330 is a computer printing operation. The input is the sorted F&I-GPA tape from operation GR-220. The output is the failure and incomplete list and the GPA list. These are printed on the mark analysis form.

Operation GR-340 is a manual key punch operation, using as input notices of grade corrections received from the schools. Often these consist of copies of the scholarship reports marked with changes. The output from this key punch operation is a set of cards in the format of records on the mark reporting tape. These cards are used as input for operation GR-350.

Operation GR-350 is a computer card-to-tape operation. The input is the card deck produced as a result of operation GR-340. The output, known as the "grade correction tape," is identical in format to the input and follows generally the format of the updated mark reporting tape, which is the output from operation GR-270. The grade correction tape serves as input for operation GR-360.

Operation GR-360 is a computer sort operation. The input is the grade correction tape that is the output from operation GR-350. The output is identical in format to the input but is sorted by student number. This tape serves as input for operation GR-370.

Operation GR-365 is a computer sort, using as input the updated mark reporting tape that is the output from operation GR-370. The output is identical in format to the input but is in sorted order by student number. This tape output serves as input for operation GR-370.

Operation GR-370 is a computer update operation on the mark reporting tape to reflect grade corrections received from the schools. The inputs are the mark reporting tape received as output from operation GR-365 and the sorted grade correction tape produced as the output from operation GR-360. The output of the operation is the updated mark report tape which is identical in format to the mark reporting tape used as input. This tape serves as input for operation GR-380. An optional output obtained from operation GR-370 is gummed labels that can be used manually to update student academic records maintained in a manual form in the schools. Usually, each of these gummed labels carries the student's name and number followed by the courses taken and grades earned in a form that can be lifted from the computer-produced output and affixed to the school's permanent record.

Operation GR-380 is a computer update operation in which the corrected grades made by a student are entered into the student's master file. The inputs are the updated mark reporting tape that is the output from operation GR-370, and the student master file tape, which can be obtained as an output from any of the operations in attendance accounting or from operation GR-190. The student master file tape must be sorted by student number within school. If it is not in that sequence, it must be sorted in an additional operation and then run again against the updated mark reporting tape. The output from the operation is the updated student master file tape.

An additional operation, contemplated but not implemented by the Research and Development Center, is the production of the California Guidance Record. This is envisioned as requiring two additional operations, GR-500 and GR-525.

Planned computer operation GR-500 will use as input: the updated mark reporting tape that is an output from operation GR-370; the student master file tape that is the output from GR-380; and the student history file. Although the first two inputs have been developed and used, the student history file has yet to be implemented. The operation GR-500 would update the student history file tape while maintaining an identical format. It would probably be necessary to precede this updating operation with a sort of the student master file tape and updated mark reporting tape to place both in student number sequence irrespective of school.

Planned computer operation GR-525 would use the planned output from operation GR-500, the student history file tape, to produce and print the California Guidance Record. The California Guidance Record represents a comprehensive summary of the material which is planned for the inclusion in the student history file.

To tie the grade reporting system to the registration and scheduling subsystem and the attendance accounting subsystem, operations GR-150 through GR-190 are used. These update student master file through the use of student course change forms.

Operation GR-150 is a computer sort operation using as input the student master file. This can be obtained from any number of places since the first operation on it is this sort operation. The output is the sorted student master file in order by student name within counselor within school. This output serves as input for operation GR-160.

Operation GR-160 is a computer update and print operation that produces the student course change forms and notes the identification of the forms in the student master file records. The input is the sorted student master file tape, obtained as the output from operation GR-150. The tape output is the student master file including the page and line number of the student course change form applying to each student. The printed output is the student course change document. The student master file output normally is used as input for operation GR-185, but need not be.

Operation XGR-165 is an optical reader operation performed on the student course change documents received from the school. These documents may be in any order within school. The output of the operation is a set of cards in a binary format. These cards serve as input for operation GR-170.

Operation GR-170 is a computer decode and convert-to-tape operation. The input is the card output produced by operation XGR-165. The output is a tape listing the decoded course changes. This tape serves as input for operation GR-180.

Operation GR-180 is a computer sort operation, using as input the tape that was the output of operation GR-170. The output is identical in format to the input but in page and line number sequence within school. This output serves as the input for operation GR-190.

Operation GR-185 is a computer sort operation, using as input the student master file tape, which may be obtained as an output from operation GR-160. The output is identical to the input but is in sorted order by page and line number to match the student course change documents. The student master file serves as input for operation GR-190.

Operation GR-190 is a computer update operation on the student master file to reflect course changes. The input is the student master file tape produced as output from operation GR-185. The other input is the sorted course change tape produced as an output from operation GR-180. The major output from the operation is the student master file tape reflecting changes in the courses for which students are registered. For convenience in later operations, an additonal output is also produced referred to as the "condensed student master file." The purpose of producing this additional tape, which serves as input for operation GR-200, is to reduce the amount of tape-passing necessary in order to be able to produce the grade data sheets later. Since grades must be accumulated for as many as eight courses per student, passing the long student master file tape eight times per student uses a large amount of computer time. Since the essential data needed for producing the grade data sheets are available during the course of performing operation GR-190 to update the student master file, they can be extracted and written as a condensed student master file tape.

Test Scoring and Analysis Subsystem

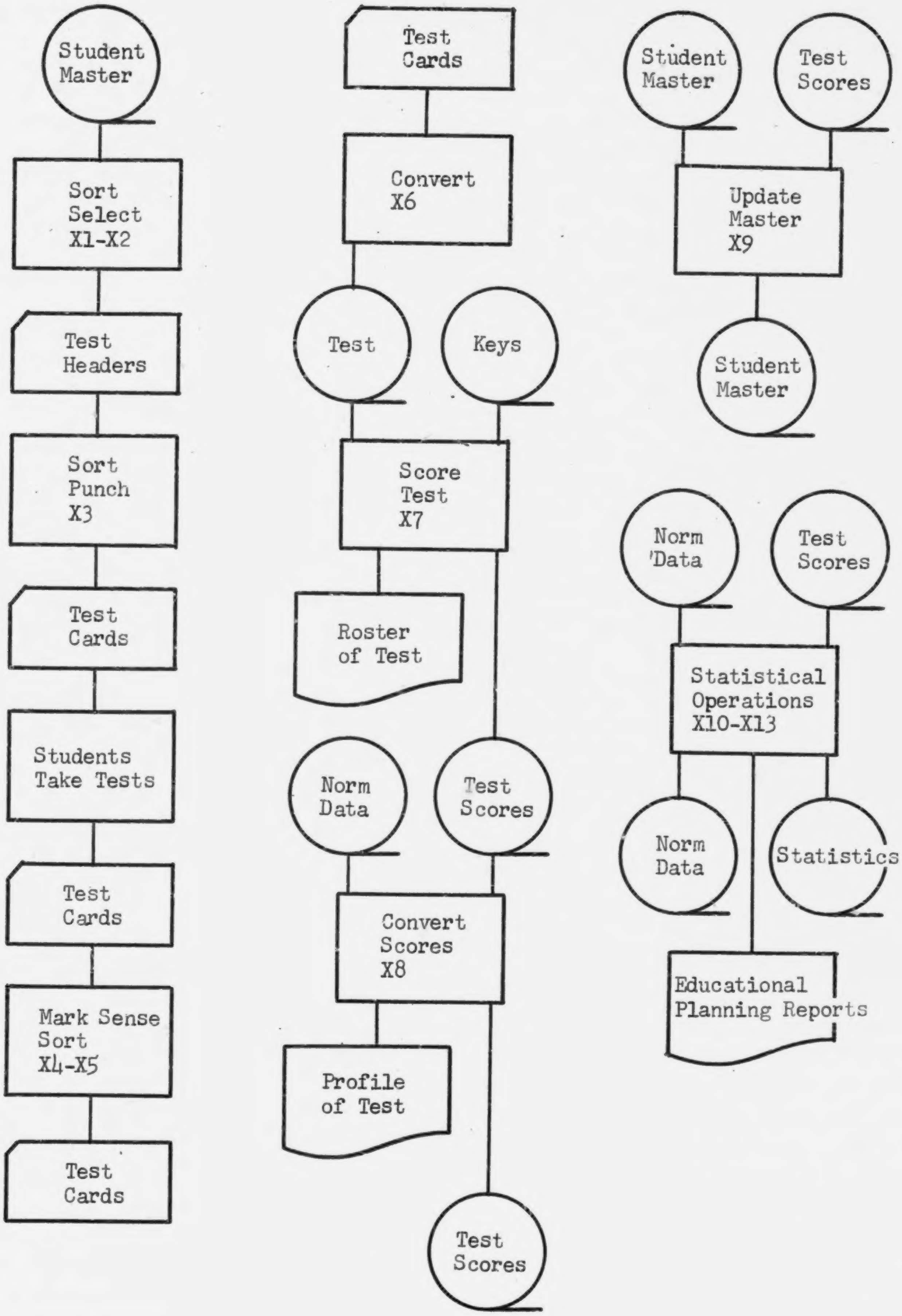
The frequency with which the test scoring and analysis operations may be done depends upon the local option of the schools. Typically, in the schools of California, it has been planned to schedule tests throughout the state during certain months of the year. This has the effect of concentrating the activity in this subsystem during those time periods. The schools are informed periodically of which aptitude and achievement tests can be handled by the subsystem.

The test scoring and analysis subsystem implemented by the Research and Development Center is a modification of the FAST test scoring system. Because this was a workable system, extensive additional developmental work has not been done, nor has a thorough documentation been made of the particular way in which the test scoring and analysis subsystem operates. Also, some of the operations contemplated within the test scoring and analysis subsystem, such as those for the educational planning report, have yet to be implemented. Statistical operations to develop statistical data and to develop local normative data have been run only on a test basis.

Operation XTO-1 is a computer sort that is initiated when a school sends data on what students are to be tested and what tests the school desires to use. The input is the student master file tape, which may be obtained from any of a number of sources. The output is the student master file sorted by student within room within grade level within school. The output serves as input for operation XTO-2.

Operation XTO-2 is a computer card-to-tape operation, using as input the sorted student master file that is the output of operation XTO-1. This operation extracts the identifying information from the individual student records that will be affected by the test results and, for each student, punches test header cards, which serve as input for operation XTO-3.

Summary of Test Scoring and Analysis Subsystem


Student Master
Sort Select X1-X2
Test Headers
Sort Punch X3
Test Cards
Students Take Tests
Test Cards
Mark Sense Sort X4-X5
Test Cards
Test Cards
Convert X6
Test
Keys
Score Test X7
Roster of Test
Norm Data
Test Scores
Convert Scores X8
Profile of Test
Test Scores
Student Master
Test Scores
Update Master X9
Student Master
Norm Data
Test Scores
Statistical Operations X10-X13
Norm Data
Statistics
Educational Planning Reports

Operation XTO-3 is performed on punched card equipment. The header cards that are the output from operation XTO-2 are sorted and collated with the actual test cards. After intersperse gang-punching, the headers are sorted out and discarded. The actual test cards are sorted into test administration sequence and sent to the schools. After they are returned from the schools, these cards serve as input to operation XTO-4.

Operation XTO-4 is a mark sense operation done on punched card equipment, using as input the cards which were the output of operation XTO-3 and which have been returned from the school. This operation converts the electrographic marks made by students in taking the tests into punches on the same cards which were marked. The input deck, which is also the output deck, serves as input for operation XTO-5.

Operation XTO-5 is a punched card sort operation to sort the test cards in order by type of test. This operation is necessary only when more than one type of test is taken at a time and the cards cards are returned to the data processing center in mixed order by test. If the school has maintained the original sort, the sort sequence of the cards coming from the school is by student within room within school. The output is the same cards that served as the input, but they are grouped by test. These cards serve as input to operation XTO-6.

Operation XTO-6 is a computer card-to-tape operation, using as input the cards that were the output from operation XTO-5. The tape produced as output maintains the card image of the input. This tape serves as input for operation XTO-7.

Operation XTO-7 is a computer test scoring operation, using as input the output of operation XTO-6. An additional input is a key tape for the tests to be scored. One output is a test score tape, which carries forward the information that was on the test tape and adds to it the scores that were computed during this scoring operation. This tape serves as input for operation XTO-8. The scoring may involve right answers only, or right answers minus wrong answers, or some fraction of rights minus some fraction of wrongs. Multiple key scoring is possible. The other output from the test scoring operation is the roster of test results. This roster is sent to the school.

Operation XTO-8 is a computer test scoring operation using as input the test score tape that is the output from operation XTO-7. Also used as input is a tape containing norm data for the tests being scored. The operation calculates from the scores on the test score tape the percentile and stanine scores and produces as output an updated version of the test score tape containing these additional data. This tape is used as input to operation XTO-9. The printed output is a profile of test results.

Operation XTO-9 is a computer master file update operation. The two inputs are the student master file tape, which may be obtained from any of several sources, and the test score tape that is the output of operation XTO-8. Both tapes must be in the same sort order. Hence, if the student master file tape is not obtained directly as an output from operation XTO-1, it must be returned to the sort order resulting from operation XTO-1 before being used as an input to operation XTO-9. The output from the operation is an updated version of the student master file, containing the current test scores achieved on the test given together with the identification of the test.

Operation XTO-10 is planned as a computer update operation on the norm data used in operation XTO-8. The input consists of the test score tape that is the output from operation XTO-8 and the norm data tape that served as an input from operation XTO-8. The output is the updated version of the norm data tape. A second output is a statistical summary tape, which would serve as input for operation XTO-11.

Operation XTO-11 is planned as a computer operation to perform statistical analyses of the data obtained from the statistical summary tape, which could be the output of operation XTO-10. The other input to this planned operation is a statistical history tape. One output from this operation is an updated version of the statistical history tape. Optical printed output may be lists of results of selected statistical operations. The most common statistical operations planned for are multiple regression analysis, analysis of variance, and correlation analysis in order to serve as a basis for developing the underlying data for the educational planning report. The statistical tape produced as the output of this run would serve as the input for operation XTO-12.

Operation XTO-12 is planned as a computer exception processing operation to produce the educational planning report at the detailed level. The two inputs contemplated are the statistical summary tape that could be an output from operation XTO-11 and the student master file tape, which should be in the same order it was when used as input for operation XTO-9. The outputs produced by the operation are an augmented version of the statistical tape which would serve as an input for operation XTO-13, and the printed educational planning report. The educational planning report would be sent to the administrator and counselors of the schools.

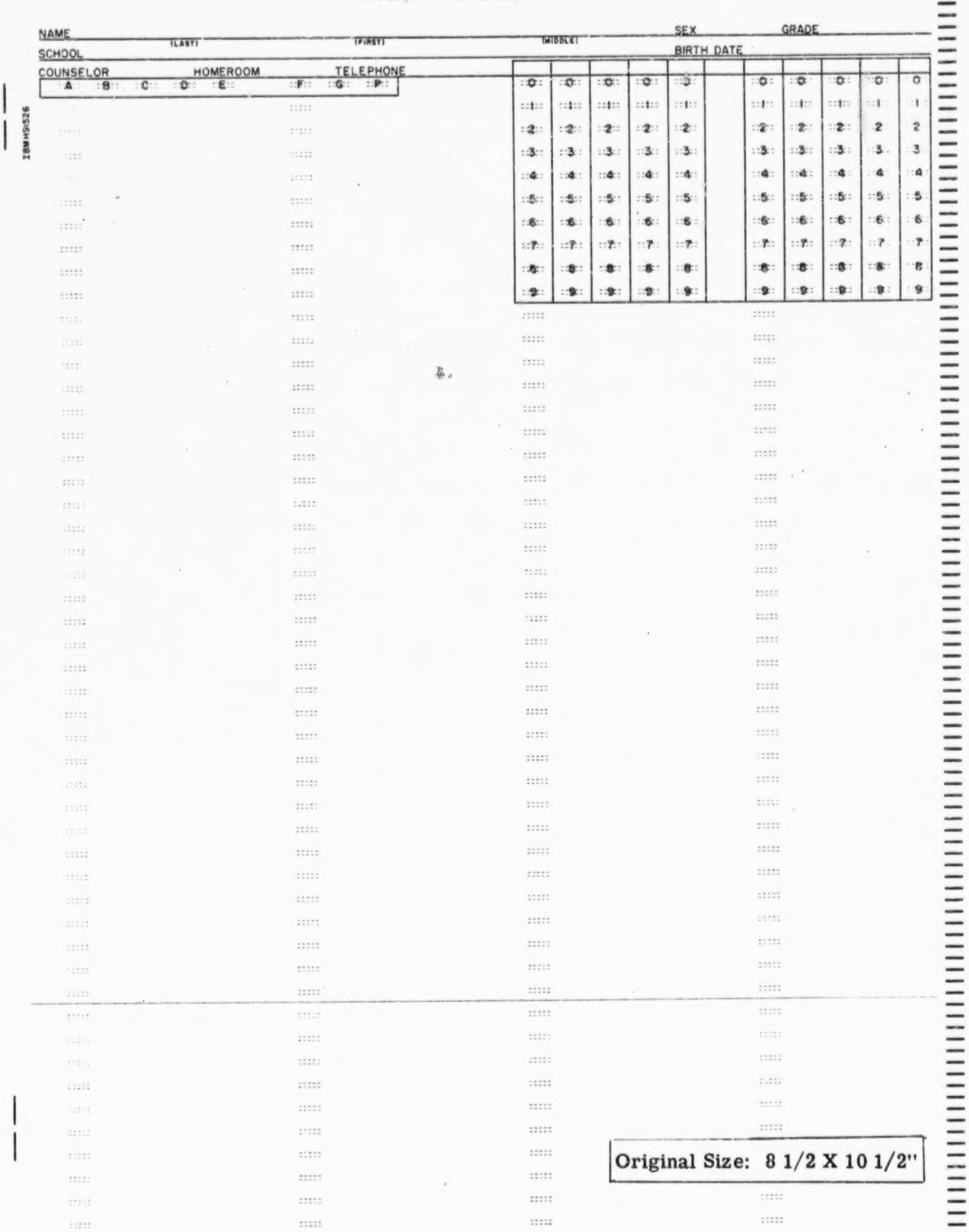
Operation XTO-13 is planned as a computer exception operation to produce the educational planning report at a summary level, such as appropriate for district, county, and state use. The inputs contemplated for this operation are the augmented statistical tape produced as an output from operation XTO-12 and the master schedule tape, which can come from a registration and scheduling subsystem operation such as operation MS-80. The output from operation XTO-13 is the educational planning summary which has been designed for use at the upper administrative levels.

A project work paper entitled "Computers for Counseling and Guidance" is included as a part of this appendix because it deals with some of the conceptions behind the educational planning report.

INPUT DOCUMENTS

Document	Frequency	Page
Course Selection Form	Term	61
Master Schedule Layout Form (Course Catalog)	Term	62
Monthly Attendance Record	School month	63
Student Data Transmittal Form	Upon enrollment	64
Grade Data Sheet	Marking period	65
Student Course Change Form	Change of registration	66
Student Master Record Card	Term	67
Course Request Card	Term	68
Student Data Transmittal Form (Card Formats)	Upon enrollment	69
Fully Automated Scoring Technique (FAST) Test Card Samples	As needed	70-73

Course Selection Form



NAME (LAST) (FIRST) (MIDDLE) SEX GRADE

SCHOOL BIRTH DATE

COUNSELOR HOMEROOM TELEPHONE

A B C D E F G P

IBM H9526

0	0	0	0	0		0	0	0	0	0
1	1	1	1	1		1	1	1	1	1
2	2	2	2	2		2	2	2	2	2
3	3	3	3	3		3	3	3	3	3
4	4	4	4	4		4	4	4	4	4
5	5	5	5	5		5	5	5	5	5
6	6	6	6	6		6	6	6	6	6
7	7	7	7	7		7	7	7	7	7
8	8	8	8	8		8	8	8	8	8
9	9	9	9	9		9	9	9	9	9

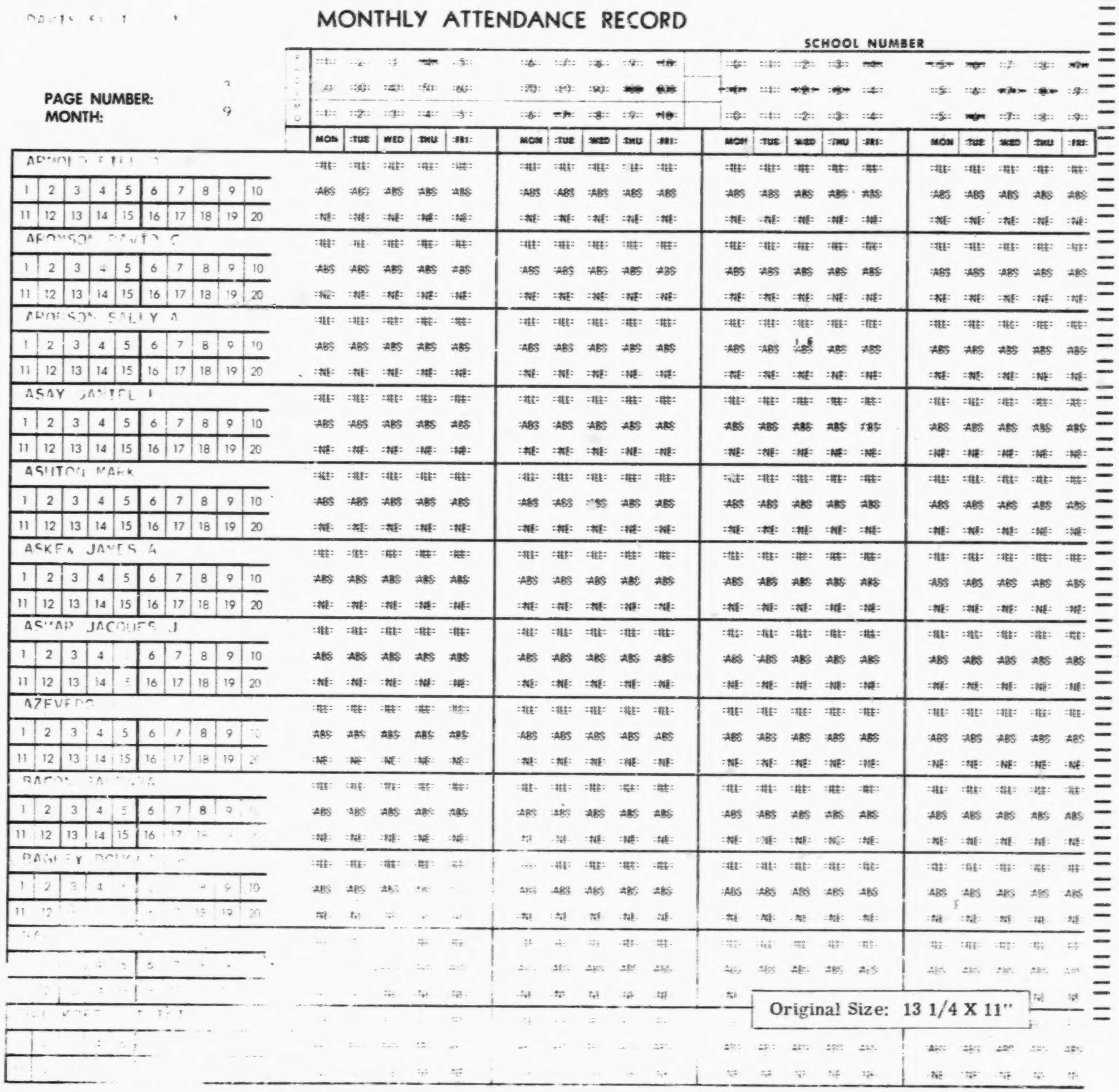
Original Size: 8 1/2 X 10 1/2"

3518387

MASTER SCHEDULE LAYOUT FORM

Course No.	Time Pattern	S	Min.	Max.	Teacher Name	Course Title	Teacher No.	Room No.	School No.	Class Lunch Hr. A or B
1-5	6-11	15	16-18	19-21	22-35	44-57	36-38	41-43	75-79	

Original Size: 11 X 8 1/2"



DAVIS [illegible]

MONTHLY ATTENDANCE RECORD

PAGE NUMBER: 3
MONTH: 9

SCHOOL NUMBER

PAGE	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9
	10	30	40	50	60	70	80	90	00	00	5	1	2	3	4	5	6	7	8	9
MO	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9
	MON	TUE	WED	THU	FRI	MON	TUE	WED	THU	FRI	MON	TUE	WED	THU	FRI	MON	TUE	WED	THU	FRI
AR[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1 2 3 4 5 6 7 8 9 10	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS
11 12 13 14 15 16 17 18 19 20	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
ARONSON DAVID C	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1 2 3 4 5 6 7 8 9 10	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS
11 12 13 14 15 16 17 18 19 20	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
ARONSON SALLY A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1 2 3 4 5 6 7 8 9 10	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS
11 12 13 14 15 16 17 18 19 20	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
ASAY DANIEL I	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1 2 3 4 5 6 7 8 9 10	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS
11 12 13 14 15 16 17 18 19 20	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
ASHTON MARK	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1 2 3 4 5 6 7 8 9 10	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS
11 12 13 14 15 16 17 18 19 20	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
ASKEW JAMES A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1 2 3 4 5 6 7 8 9 10	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS
11 12 13 14 15 16 17 18 19 20	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
AS[illegible]AR JACQUES J	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1 2 3 4 6 7 8 9 10	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS
11 12 13 14 16 17 18 19 20	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
AZEVEDO	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1 2 3 4 5 6 7 8 9 10	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS
11 12 13 14 15 16 17 18 19 20	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
BACON BARBARA	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1 2 3 4 5 6 7 8 9	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS
11 12 13 14 15 16 17	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
BAGLEY [illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1 2 3 4 9 10	ABS	ABS	ABS			ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS	ABS
11 12 18 19 20	NE	NE				NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

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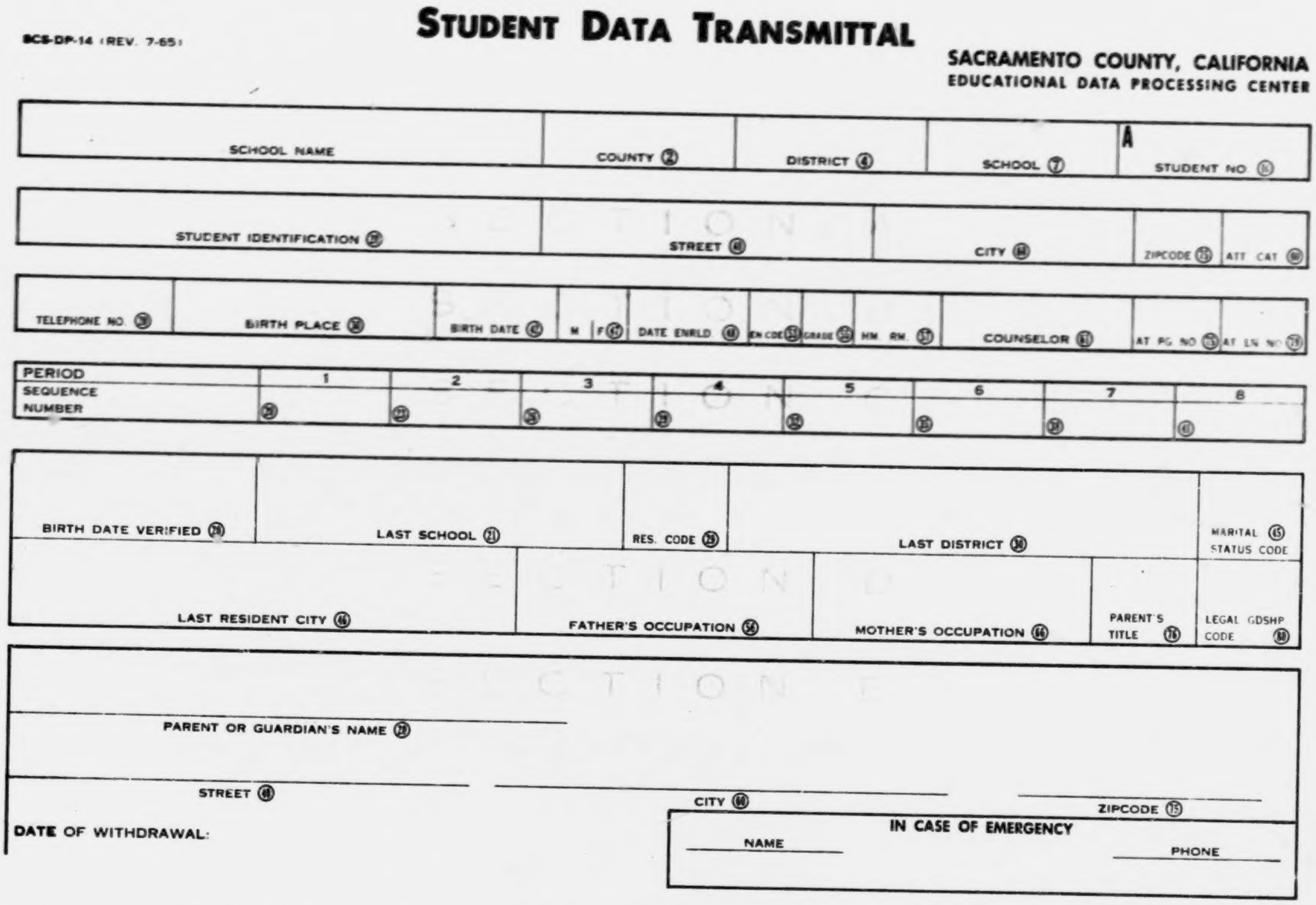


BCS-DP-14 (REV. 7-65)

STUDENT DATA TRANSMITTAL

SACRAMENTO COUNTY, CALIFORNIA
EDUCATIONAL DATA PROCESSING CENTER

SCHOOL NAME	COUNTY ②	DISTRICT ④	SCHOOL ⑦	A STUDENT NO.

STUDENT IDENTIFICATION	STREET	CITY	ZIPCODE ⑮	ATT. CAT

TELEPHONE NO.	BIRTH PLACE	BIRTH DATE	M | F	DATE ENRLD.	EN CDE	GRADE	HM. RM.	COUNSELOR	AT PG NO	AT LN NO

PERIOD	1	2	3	4	5	6	7	8
SEQUENCE NUMBER								

BIRTH DATE VERIFIED	LAST SCHOOL	RES. CODE	LAST DISTRICT	MARITAL STATUS CODE
LAST RESIDENT CITY	FATHER'S OCCUPATION	MOTHER'S OCCUPATION	PARENT'S TITLE	LEGAL GDSHP CODE

PARENT OR GUARDIAN'S NAME

STREET

CITY

ZIPCODE ⑮

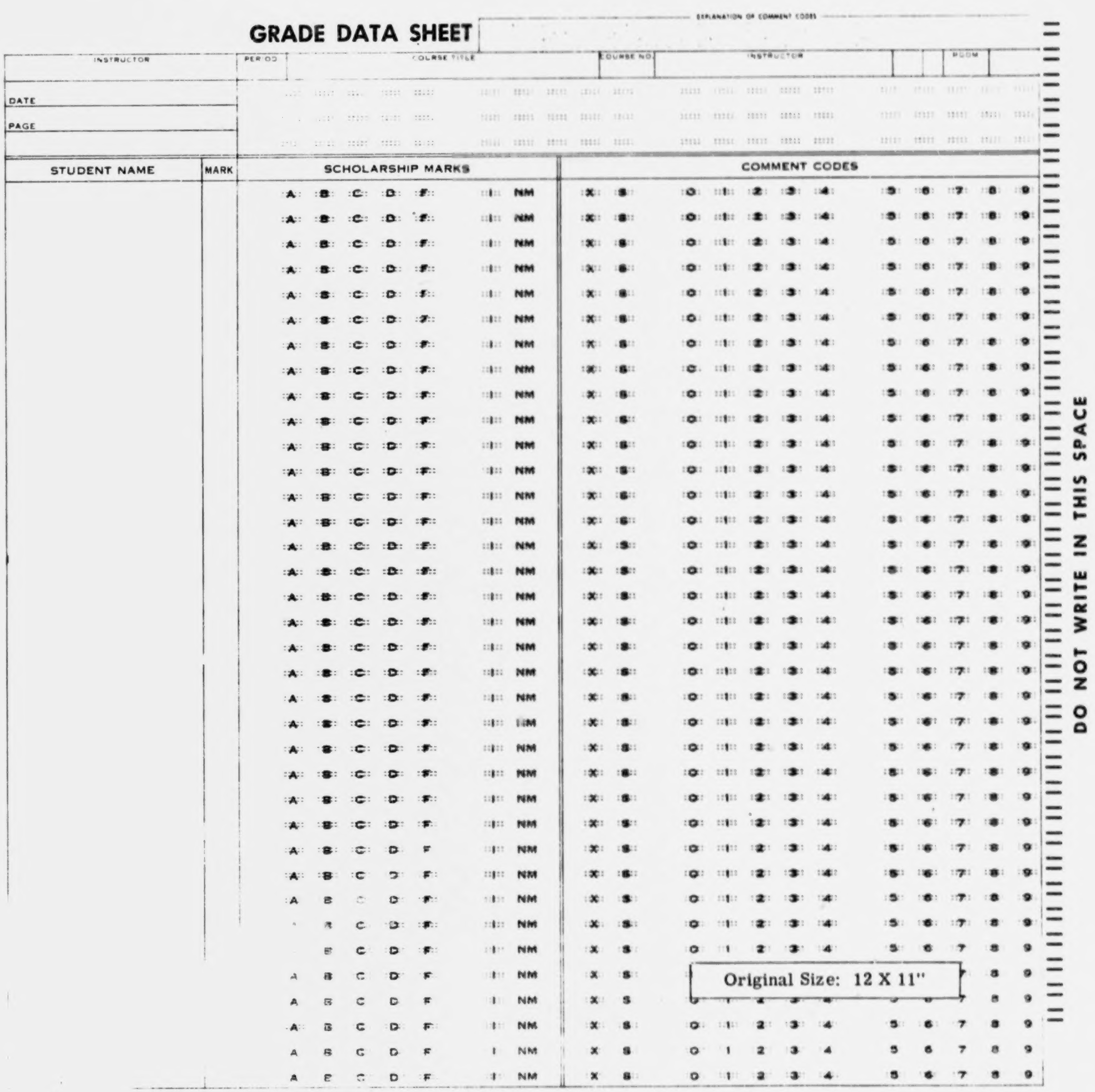
DATE OF WITHDRAWAL:

IN CASE OF EMERGENCY

NAME

PHONE

Same Size



GRADE DATA SHEET

EXPLANATION OF COMMENT CODES

INSTRUCTOR	PERIOD	COURSE TITLE	COURSE NO.	INSTRUCTOR			ROOM
DATE							
PAGE							

STUDENT NAME	MARK	SCHOLARSHIP MARKS							COMMENT CODES											
		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
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		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
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		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
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		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
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			B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9
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		A	B	C	D	F	I	NM	X	S								7	8	9
		A	B	C	D	F	I	NM	X	S								7	8	9
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		A	B	C	D	F	I	NM	X	S	0	1	2	3	4	5	6	7	8	9

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Original Size: 12 X 11"

STUDENT COURSE CHANGE

NAME:
NO:
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NAME:
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NAME:
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											SCHOOL NUMBER									
PAGE	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9
	20	30	40	50	60	70	80	90	100	200	0	1	2	3	4	5	6	7	8	9
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Original Size 14 1/4 X 11"

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Honeywell
ELECTRONIC DATA PROCESSING

Layout Form - 80 Column Card

R X	STUDENT NUMBER	GRADE	STUDENT NAME	SEX	DATE OF BIRTH			COUNSELOR NAME		HOME ROOM	DATE ENRLD			DATE LEFT				TELEPHONE NUMBER	
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	1 2 3 4 5 6 7 8	9	10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	28	29 30	31 32	33 34	35 36 37 38 39 40 41 42 43 44 45 46 47 48	49	50 51 52	53 54	55 56	57	58 59	60 61	62	63 64 65 66 67 68 69 70 71 72	73 74 75 76 77 78 79	80
1	11111111	1	111111111111111111	1	11	11	11	11111111111111	1	111	11	11	1	11	11	1	1111111111	1111111	1
2	22222222	2	222222222222222222	2	22	22	22	22222222222222	2	222	22	22	2	22	22	2	2222222222	2222222	2
3					MONTH	DAY	YEAR				MONTH	DAY	YEAR	MONTH	DAY	YEAR			
4																			1
5																			
6																			
7																			
8	88888888	8	888888888888888888	8	88	88	88	88888888888888	8	888	88	88	8	88	88	8	8888888888	8888888	8
9	99999999	9	999999999999999999	9	99	99	99	99999999999999	9	999	99	99	9	99	99	9	9999999999	9999999	9
	1 2 3 4 5 6 7 8	9	10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	28	29 30	31 32	33 34	35 36 37 38 39 40 41 42 43 44 45 46 47 48	49	50 51 52	53 54	55 56	57	58 59	60 61	62	63 64 65 66 67 68 69 70 71 72	73 74 75 76 77 78 79	80

Title STUDENT MASTER

Prepared By ______ For Program ______

By Programmer ______ Checked By ______

Date ______ Remarks ______ Same Size

Modification ______ Page ______ Of ______

MH — EDP 1034 (1/64)

County of Sacramento

OFFICE OF
T. R. SMEDBERG, SUPERINTENDENT OF SCHOOLS
6011 FOLSOM BOULEVARD
SACRAMENTO 19, CALIFORNIA

EDUCATIONAL DATA PROCESSING

Application COURSE REQUEST CARD by ____________ Date ____________ Job No. ____________ Sheet No. ____________

STUDENT NUMBER	SEX	STUDENT NAME	GRADE	SCHOOL NUMBER			HOME ROOM	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
9 9 9 9 9 9 9 9 1 2 3 4 5 6 7 8	9 9	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	9 28	9 9 29 30	9 9 9 31 32 33	9 9 9 34 35 36	9 9 9 9 37 38 39 40	9 9 9 9 41 42 43 44	9 9 9 9 45 46 47 48	9 9 9 9 49 50 51 52	9 9 9 9 53 54 55 56	9 9 9 9 57 58 59 60	9 9 9 9 61 62 63 64	9 9 9 9 65 66 67 68	9 9 9 9 69 70 71 72	9 9 9 9 73 74 75 76	9 9 9 9 77 78 79 80
9 9 9 9 9 9 9 9 1 2 3 4 5 6 7 8	9 9	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	9 28	9 9 29 30	9 9 9 31 32 33	9 9 9 34 35 36	9 9 9 9 37 38 39 40	9 9 9 9 41 42 43 44	9 9 9 9 45 46 47 48	9 9 9 9 49 50 51 52	9 9 9 9 53 54 55 56	9 9 9 9 57 58 59 60	9 9 9 9 61 62 63 64	9 9 9 9 65 66 67 68	9 9 9 9 69 70 71 72	9 9 9 9 73 74 75 76	9 9 9 9 77 78 79 80
Counselor [illegible]																	
9 9 9 9 9 9 9 9 1 2 3 4 5 6 7 8	9 9	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	9 28	9 9 29 30	9 9 9 31 32 33	9 9 9 34 35 36	9 9 9 9 37 38 39 40	9 9 9 9 41 42 43 44	9 9 9 9 45 46 47 48	9 9 9 9 49 50 51 52	9 9 9 9 53 54 55 56	9 9 9 9 57 58 59 60	9 9 9 9 61 62 63 64	9 9 9 9 65 66 67 68	9 9 9 9 69 70 71 72	9 9 9 9 73 74 75 76	9 9 9 9 77 78 79 80
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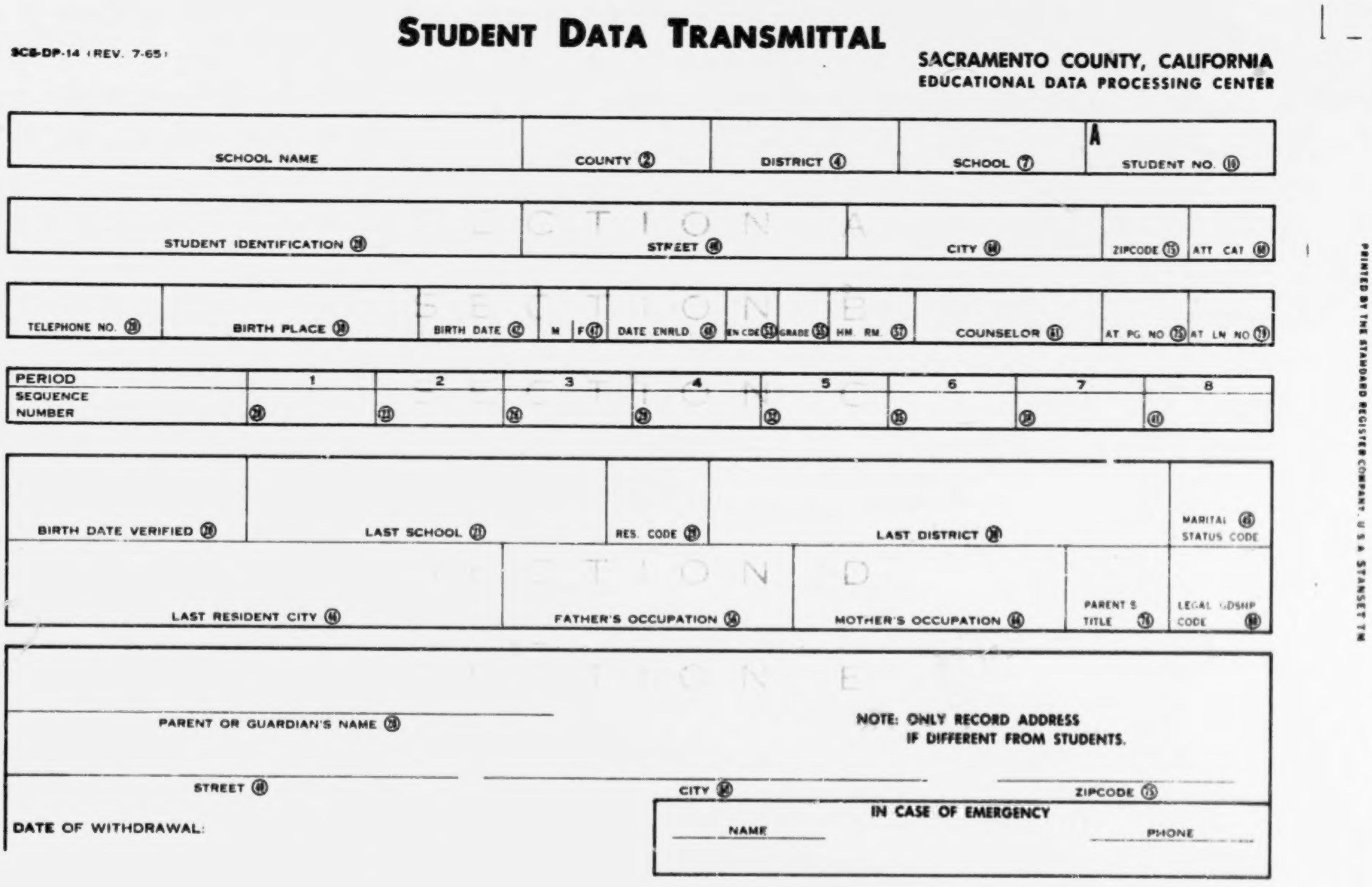


SCS-DP-14 (REV. 7-65)

STUDENT DATA TRANSMITTAL

SACRAMENTO COUNTY, CALIFORNIA
EDUCATIONAL DATA PROCESSING CENTER

				A
SCHOOL NAME	COUNTY ②	DISTRICT ④	SCHOOL ⑦	STUDENT NO. ⑪

SECTION A

STUDENT IDENTIFICATION ⑳	STREET (40)	CITY (60)	ZIPCODE (75)	ATT CAT (80)

SECTION B

TELEPHONE NO. ⑳	BIRTH PLACE (30)	BIRTH DATE (42)	M	F (47)	DATE ENRLD (48)	EN CDE (53)	GRADE (55)	HM. RM. (57)	COUNSELOR (61)	AT PG NO (75)	AT LN NO (79)

SECTION C

PERIOD	1	2	3	4	5	6	7	8
SEQUENCE NUMBER	⑳	㉓	㉖	㉙	㉜	㉟	(38)	(41)

SECTION D

BIRTH DATE VERIFIED ⑳	LAST SCHOOL ㉑	RES. CODE ㉕	LAST DISTRICT ㉚	MARITAL STATUS CODE (45)
LAST RESIDENT CITY (44)	FATHER'S OCCUPATION (54)	MOTHER'S OCCUPATION (64)	PARENT'S TITLE (76)	LEGAL GDSHP CODE (80)

SECTION E

PARENT OR GUARDIAN'S NAME ⑳

NOTE: ONLY RECORD ADDRESS
IF DIFFERENT FROM STUDENTS.

STREET (40)
CITY (60)
ZIPCODE (75)

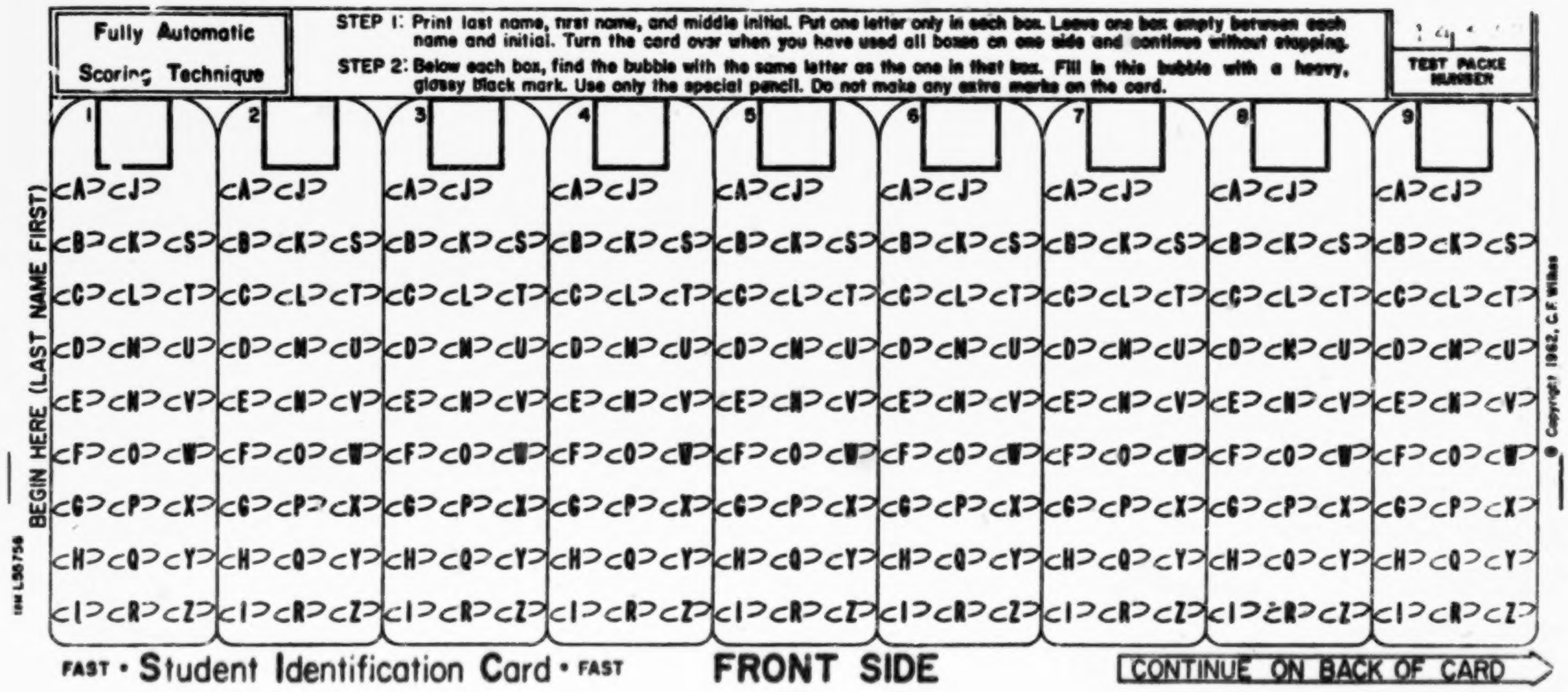
DATE OF WITHDRAWAL:

IN CASE OF EMERGENCY
NAME
PHONE

PRINTED BY THE STANDARD REGISTER COMPANY, U.S.A. STANSET TM

Same Size

Fast Test Card Sample



Fully Automatic Scoring Technique

STEP 1: Print last name, first name, and middle initial. Put one letter only in each box. Leave one box empty between each name and initial. Turn the card over when you have used all boxes on one side and continue without stopping.

STEP 2: Below each box, find the bubble with the same letter as the one in that box. Fill in this bubble with a heavy, glossy black mark. Use only the special pencil. Do not make any extra marks on the card.

TEST PACKE NUMBER

BEGIN HERE (LAST NAME FIRST)

1	2	3	4	5	6	7	8	9
A J	A J	A J	A J	A J	A J	A J	A J	A J
B K S	B K S	B K S	B K S	B K S	B K S	B K S	B K S	B K S
C L T	C L T	C L T	C L T	C L T	C L T	C L T	C L T	C L T
D M U	D M U	D M U	D M U	D M U	D M U	D M U	D M U	D M U
E N V	E N V	E N V	E N V	E N V	E N V	E N V	E N V	E N V
F O W	F O W	F O W	F O W	F O W	F O W	F O W	F O W	F O W
G P X	G P X	G P X	G P X	G P X	G P X	G P X	G P X	G P X
H Q Y	H Q Y	H Q Y	H Q Y	H Q Y	H Q Y	H Q Y	H Q Y	H Q Y
I R Z	I R Z	I R Z	I R Z	I R Z	I R Z	I R Z	I R Z	I R Z

IBM L56756

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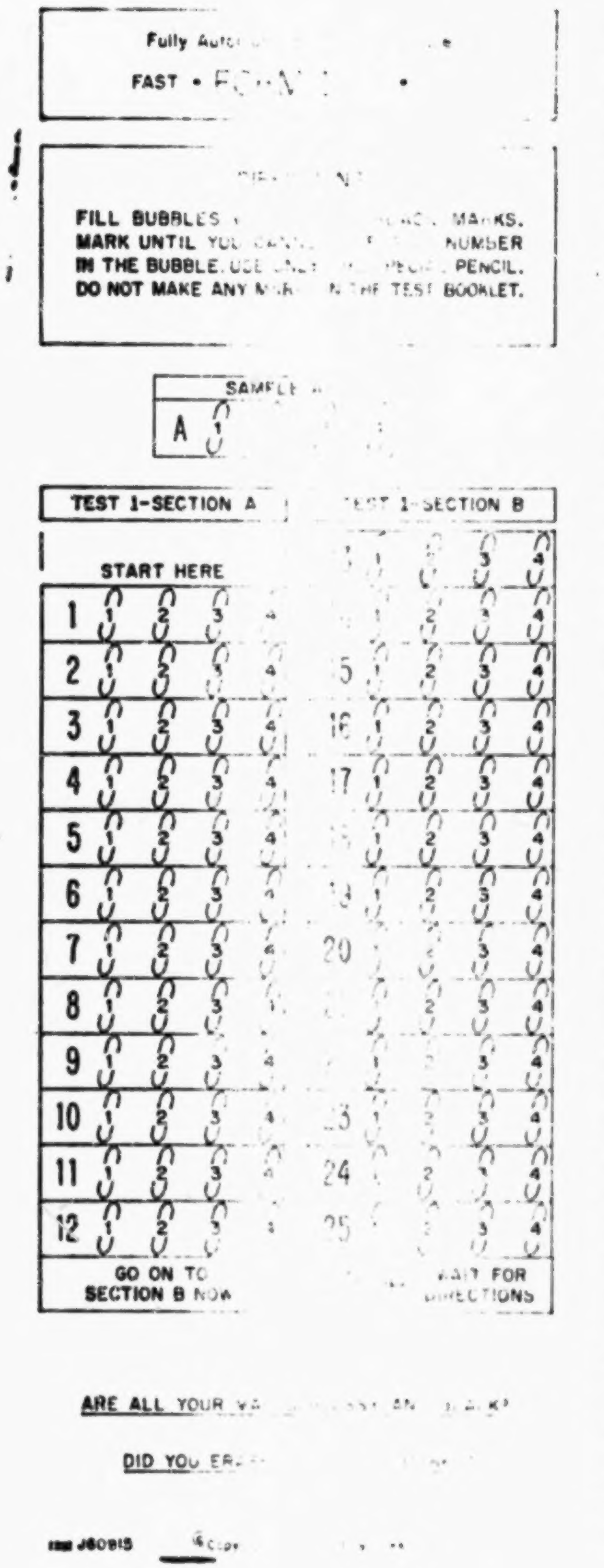
FAST • Student Identification Card • FAST

FRONT SIDE

CONTINUE ON BACK OF CARD

Same Size

Fast Test Card Samples



Fully Auto[illegible]
FAST • F[illegible] •

[illegible]
FILL BUBBLES [illegible] MARKS.
MARK UNTIL YOU [illegible] NUMBER
IN THE BUBBLE. USE [illegible] PENCIL.
DO NOT MAKE ANY [illegible] THE TEST BOOKLET.

SAMPLE [illegible]

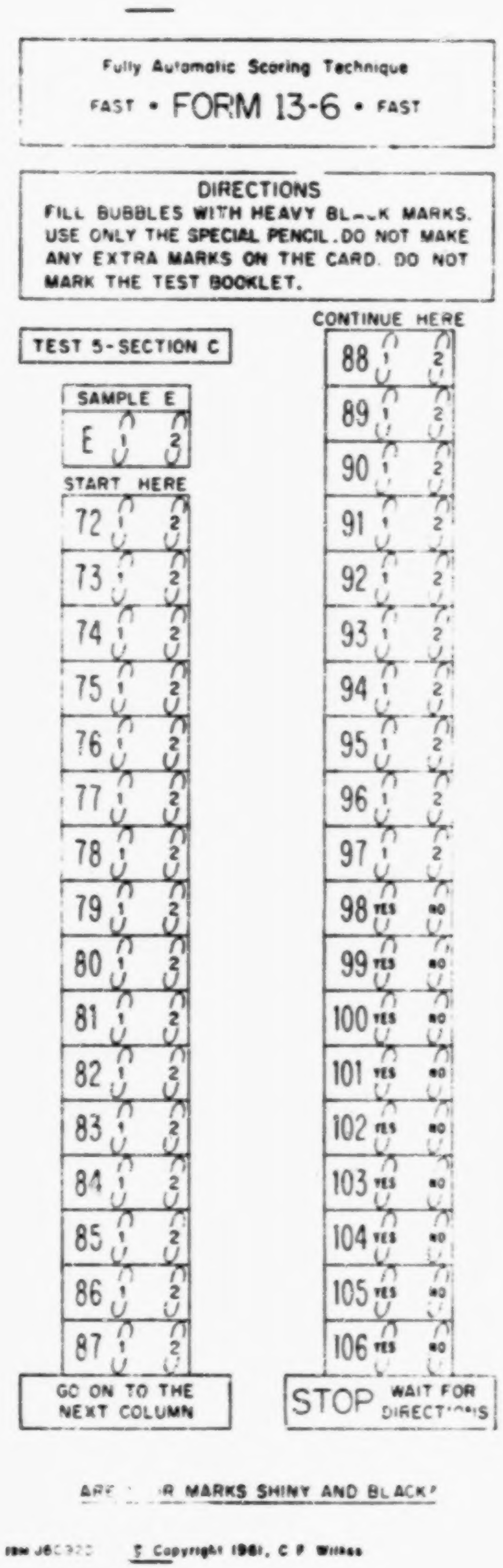
A	1			

TEST 1-SECTION A					[illegible] 1-SECTION B				
START HERE					[illegible]	1	2	3	4
1	1	2	3	4	[illegible]	1	2	3	4
2	1	2	3	4	5	1	2	3	4
3	1	2	3	4	16	1	2	3	4
4	1	2	3	4	17	1	2	3	4
5	1	2	3	4	[illegible]	1	2	3	4
6	1	2	3	4	[illegible]	1	2	3	4
7	1	2	3	4	20			3	4
8	1	2	3		[illegible]		2	3	4
9	1	2	3	4	[illegible]	1		3	4
10	1	2	3	4	3	1		3	4
11	1	2	3	4	24		2		4
12	1	2	3		25			3	4
GO ON TO SECTION B NOW							WAIT FOR DIRECTIONS		

ARE ALL YOUR [illegible]?

DID YOU ER[illegible]

IBM J6081S [illegible]



Fully Automatic Scoring Technique
FAST • FORM 13-6 • FAST

DIRECTIONS
FILL BUBBLES WITH HEAVY BLACK MARKS.
USE ONLY THE SPECIAL PENCIL. DO NOT MAKE
ANY EXTRA MARKS ON THE CARD. DO NOT
MARK THE TEST BOOKLET.

TEST 5-SECTION C

SAMPLE E		
E	1	2

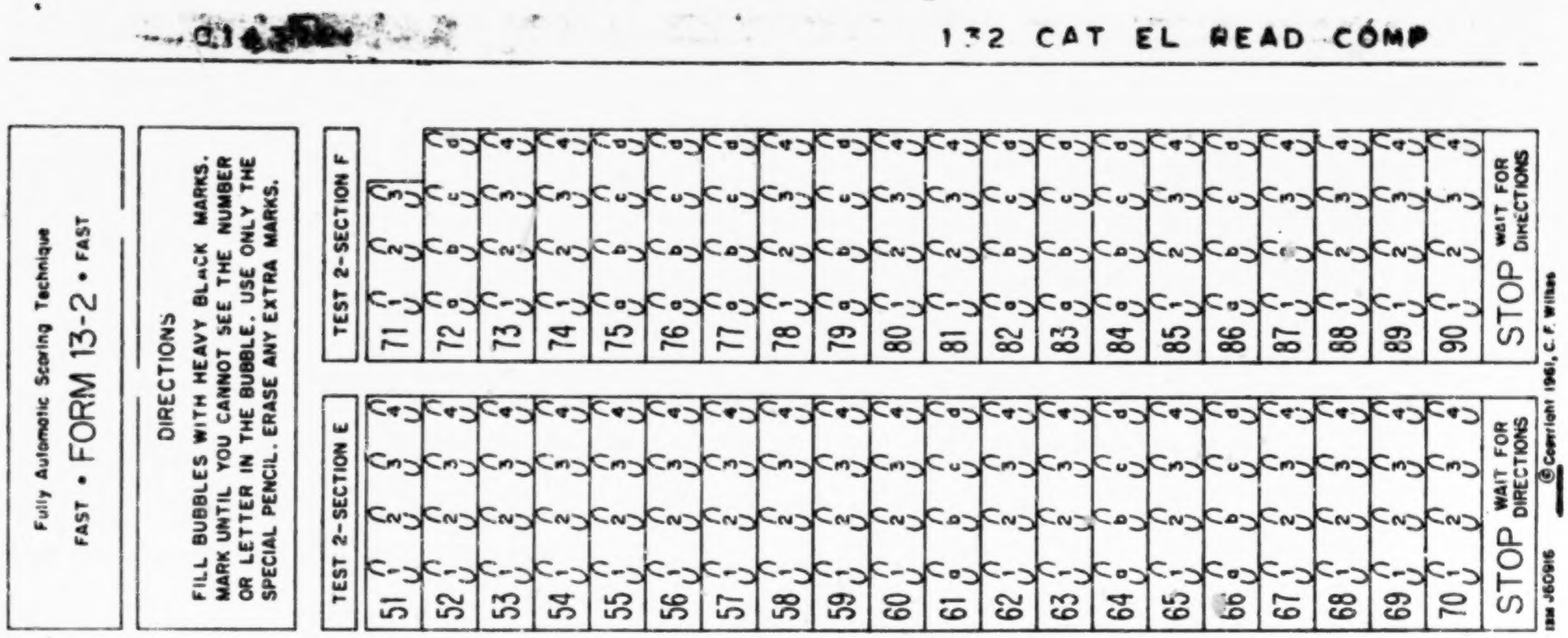
START HERE			CONTINUE HERE		
72	1	2	88	1	2
73	1	2	89	1	2
74	1	2	90	1	2
75	1	2	91	1	2
76	1	2	92	1	2
77	1	2	93	1	2
78	1	2	94	1	2
79	1	2	95	1	2
80	1	2	96	1	2
81	1	2	97	1	2
82	1	2	98	YES	NO
83	1	2	99	YES	NO
84	1	2	100	YES	NO
85	1	2	101	YES	NO
86	1	2	102	YES	NO
87	1	2	103	YES	NO
			104	YES	NO
			105	YES	NO
			106	YES	NO
GO ON TO THE NEXT COLUMN			STOP WAIT FOR DIRECTIONS		

ARE [illegible]R MARKS SHINY AND BLACK?

IBM J6C920 © Copyright 1961, C F Wilkes

Same Size

Fast Test Card Samples



1?2 CAT EL READ COMP

Fully Automatic Scoring Technique

FAST • FORM 13-2 • FAST

DIRECTIONS

FILL BUBBLES WITH HEAVY BLACK MARKS. MARK UNTIL YOU CANNOT SEE THE NUMBER OR LETTER IN THE BUBBLE. USE ONLY THE SPECIAL PENCIL. ERASE ANY EXTRA MARKS.

TEST 2–SECTION E

51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70

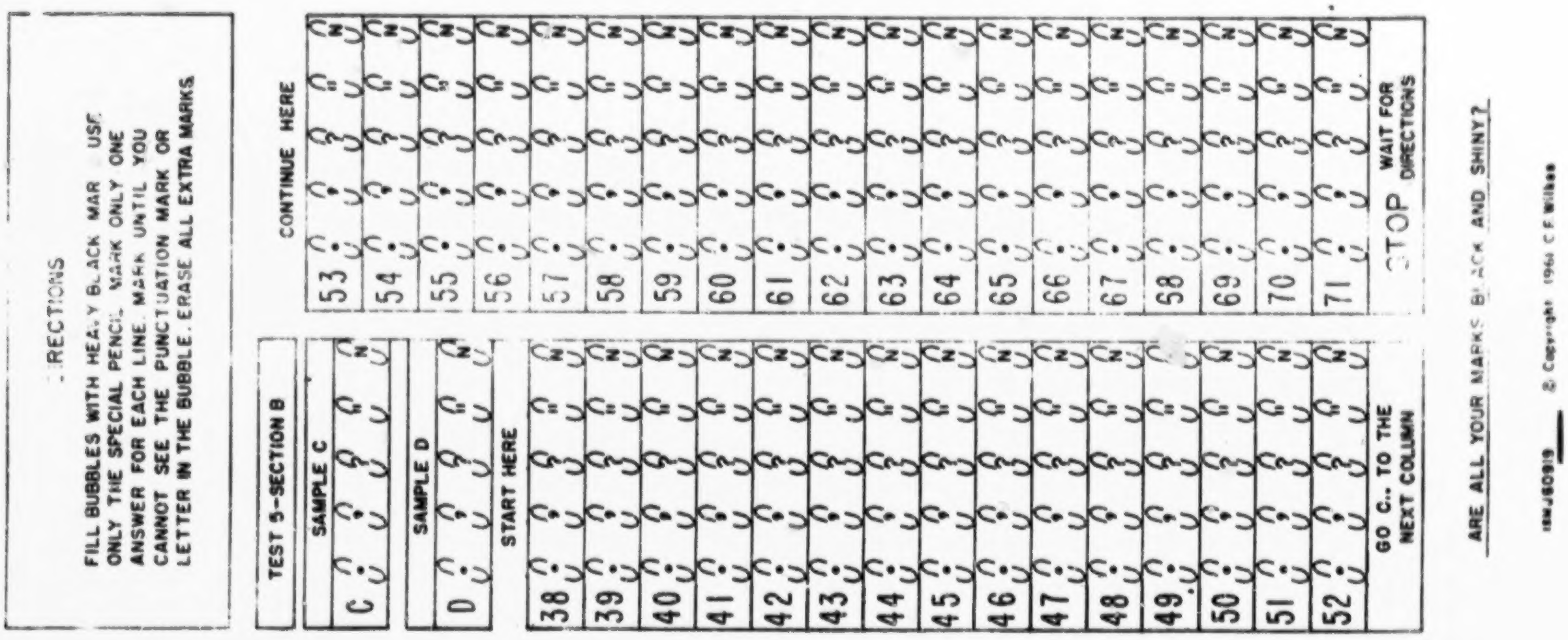
STOP WAIT FOR DIRECTIONS

TEST 2–SECTION F

71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90

STOP WAIT FOR DIRECTIONS

ISM J60916 ©Copyright 1961, C.F. Wilkes



DIRECTIONS

FILL BUBBLES WITH HEAVY BLACK MAR USE ONLY THE SPECIAL PENCIL MARK ONLY ONE ANSWER FOR EACH LINE MARK UNTIL YOU CANNOT SEE THE PUNCTUATION MARK OR LETTER IN THE BUBBLE. ERASE ALL EXTRA MARKS

TEST 5–SECTION B

SAMPLE C

C

SAMPLE D

D

START HERE

38 39 40 41 42 43 44 45 46 47 48 49 50 51 52

GO ON TO THE NEXT COLUMN

CONTINUE HERE

53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71

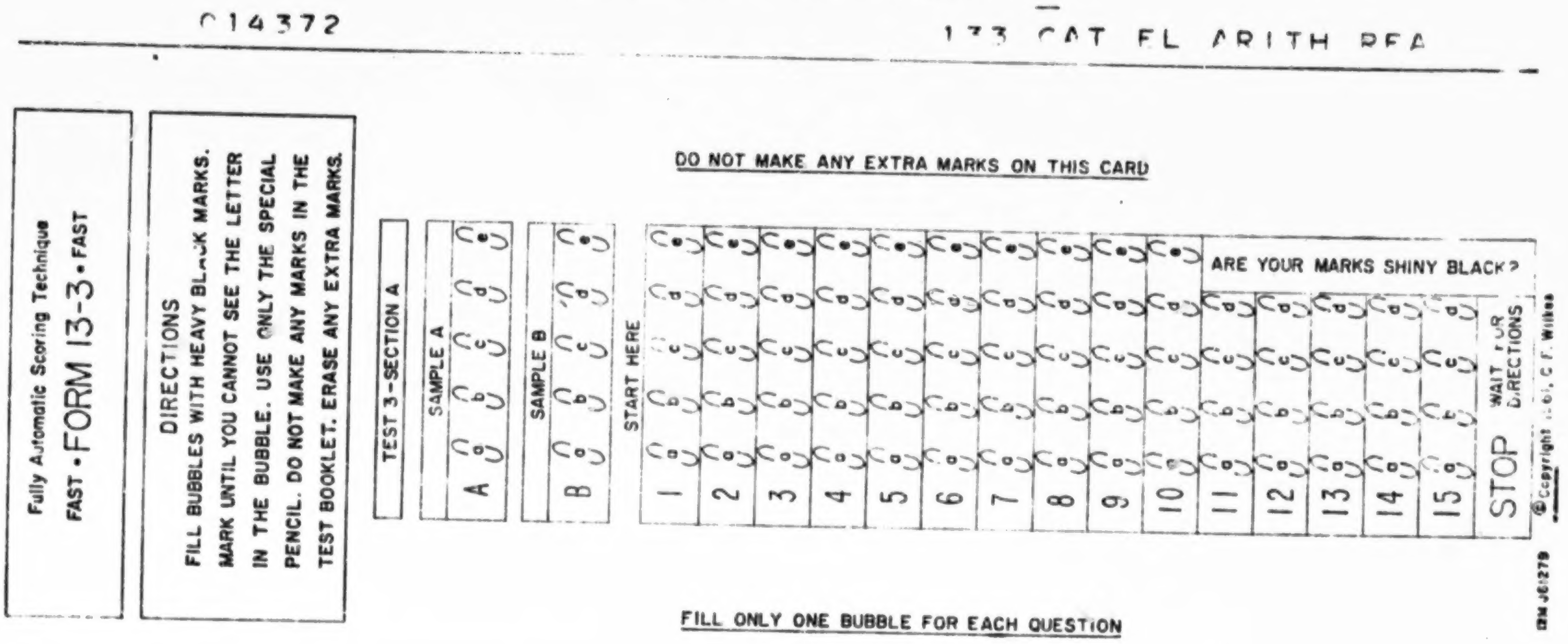
STOP WAIT FOR DIRECTIONS

ARE ALL YOUR MARKS BLACK AND SHINY?

ISM J60919 © Copyright 1961 C.F. Wilkes

Same Size

Fast Test Card Samples



014372 173 CAT EL ARITH REA

Fully Automatic Scoring Technique
FAST • FORM 13-3 • FAST

DIRECTIONS
FILL BUBBLES WITH HEAVY BLACK MARKS. MARK UNTIL YOU CANNOT SEE THE LETTER IN THE BUBBLE. USE ONLY THE SPECIAL PENCIL. DO NOT MAKE ANY MARKS IN THE TEST BOOKLET. ERASE ANY EXTRA MARKS.

TEST 3-SECTION A

DO NOT MAKE ANY EXTRA MARKS ON THIS CARD

SAMPLE A
SAMPLE B
START HERE

ARE YOUR MARKS SHINY BLACK?

STOP WAIT FOR DIRECTIONS

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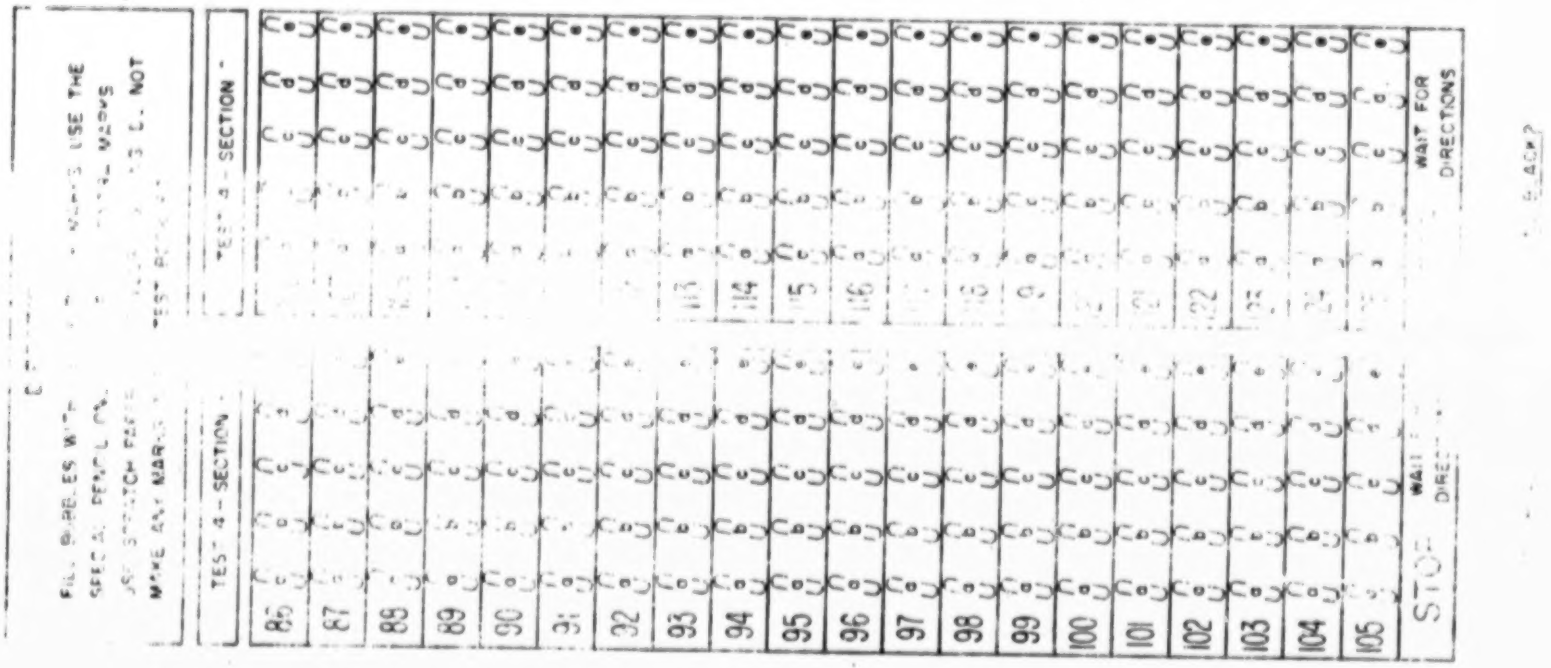
IBM J61279

FILL ONLY ONE BUBBLE FOR EACH QUESTION

A
B
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
a
b
c
d
e



TEST 4 - SECTION

FILL BUBBLES WITH ... USE THE SPECIAL PENCIL ON... USE SCRATCH PAPER ... MAKE ANY MARKS ... TEST BOOKLET

STOP WAIT FOR DIRECTIONS

86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
113
114
115
116
122

Same Size

OUTPUT DOCUMENTS

Document	Frequency	Page
Course Conflict Matrix (Course Tally)	Term	75
Course Tally (Simple Tally)	Term	76
List of Courses (Master Schedule List)	Term	77
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Locator Cards	Term	79
Attendance Register	School month	80
Irregular Attendance Analysis Report	School month	81
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California Guidance Record	Term (?)	84
Gummed Labels	Term	85
Roster of Test Results	As needed	86
Profile of Test Results	As needed	87
Educational Planning Report	As needed	88
Unsuccessful Scheduling Attempts	Term	89

BRUNSWICK HIGH 13334456 65-66 COURSE CONFLICT MATRIX WELLESLEY TEST A

COURSE DESC.	NO.	007	008	013	014	019	020	021	025	029	030	033	034	039	040	103	105	106	109	113	116
	TOTALS	19	106	139	236	224	102	85	13	15	23	28	6	16	27	373	66	248	32	139	26
ENGLISH 2	007	19*	.	.	.	.	.	.	.	.	3	5	.	1	.	.	1	.	.	.	.
ENGLISH 2	008	.	106*	.	.	.	.	.	5	.	1	9	.	1	.	11	55	.	.	2	.
ENGLISH 3	013	.	.	139*	.	.	.	.	4	6	14	1	1	8	.	128	2	4	1	.	.
ENGLISH 3	014	.	.	.	236*	.	.	.	1	7	4	3	1	5	.	216	6	10	1	5	1
ENGLISH 4	019	.	.	.	.	224*	.	.	2	1	1	8	3	1	21	10	.	119	20	87	20
ENGLISH 4	020	.	.	.	.	.	102*	.	.	.	.	.	.	.	4	2	1	67	8	14	1
ENGLISH 4	021	.	.	.	.	.	.	85*	1	1	.	2	1	.	2	6	1	47	2	31	3
DRAM 1	025	.	5	4	1	2	.	1	13*	.	1	1	.	.	.	5	3	2	.	1	.
JOURN 1	029	.	.	6	7	1	.	1	.	15*	.	2	.	.	1	13	1	.	.	2	.
JOURN 2	030	3	1	14	4	1	.	.	1	.	23*	.	.	.	.	19	.	.	.	1	.
SPEECH 1	033	5	9	1	3	8	.	2	1	2	.	28*	.	.	2	5	4	5	.	5	.
SPEECH 2	034	.	.	1	1	3	.	1	.	.	.	.	6*	.	.	1	.	2	1	1	.
DRAM 2	039	1	1	8	5	1	.	.	.	.	.	.	.	16*	.	12	2	1	.	.	.
DRAM 3	040	.	.	.	.	21	4	2	.	1	.	2	.	.	27*	.	.	13	.	14	2
U S HIST	103	.	11	128	216	10	2	6	5	13	19	5	1	12	.	373*	6	20	4	3	1
WRLD GEOG	105	1	55	2	6	.	1	1	3	1	.	4	.	2	.	6	66*	.	.	1	.
AMER GOVT	106	.	.	4	10	119	67	47	2	.	.	5	2	1	13	20	.	248*	19	.	23
ECONOMIC	109	.	.	1	1	20	8	2	.	.	.	.	1	.	.	4	.	19	32*	4	.
GOVT POD	113	.	2	.	5	87	14	31	1	2	1	5	1	.	14	3	1	.	4	139*	.
POD ECON	116	.	.	.	1	20	1	3	.	.	.	.	.	.	2	1	.	23	.	.	26*
PL GEOM	205	10	33	.	6	2	.	.	2	.	2	8	.	.	.	4	.	1	1	1	.
TRIG	206	.	.	1	1	6	.	.	.	.	.	.	.	.	.	1	.	3	1	2	.
SLD GEOM	207	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SR MATH	208	.	.	.	2	2	12	11	.	.	.	.	1	.	.	2	.	19	2	3	1
GEOM HNR	209	8	3	.	.	.	.	.	1	.	1	3	.	.	.	.	1	.	.	.	.
ADV ALG	211	.	.	79	60	5	.	1	2	1	6	.	.	2	.	129	.	6	1	4	.
TRIGSDHNR	212	.	.	8	3	.	.	.	.	.	.	.	2	1	.	10	.	.	.	.	.
TRIG SOL	213	.	.	.	.	65	.	.	.	.	.	2	.	.	4	2	.	36	1	23	1
BIOLOGY	252	16	9	.	1	.	.	.	1	1	3	7	.	.	.	1	.	.	.	.	.
BIOLOGY	253	2	37	1	2	.	.	.	2	.	.	6	.	1	.	2	10	.	.	.	.
CHEMISTRY	254	.	.	.	.	124	1	.	1	.	.	2	1	.	9	5	.	66	10	47	7
PHYSICS	255	.	.	83	59	9	.	.	1	2	3	1	2	2	.	128	.	11	.	2	3
SR SCI	256	.	.	.	11	10	4	18	.	2	1	.	.	.	2	9	.	21	3	11	4
FRENCH 1	301	1	3	16	6	2	.	.	2	.	3	.	.	3	.	19	2	4	.	.	1
FRENCH 2	302	2	9	1	2	12	.	.	1	.	.	4	.	1	5	3	2	7	.	5	.
FRENCH 3	303	.	.	8	1	.	.	.	.	2	2	.	.	.	.	8	.	.	.	.	.
LATIN 2	306	14	24	.	.	.	.	.	2	.	3	8	.	.	.	.	.	.	.	.	.
LATIN 3	307	.	.	9	3	4	.	.	.	1	.	1	.	3	.	11	1	2	.	3	.
LATIN 4	308	.	.	.	.	4	.	.	.	.	.	.	1	.	.	.	.	1	.	2	.
SPANISH 1	309	.	5	9	11	6	.	1	.	2	.	1	.	1	1	17	4	5	1	1	1
SPANISH 2	310	1	4	2	3	13	.	.	1	.	.	3	.	.	2	4	3	8	.	4	1
SPANISH 3	311	.	.	.	.	1	3	.	.	.	.	.	.	.	.	1	.	3	.	.	.
BKKPG 1	405	1	50	2	21	.	2	.	2	3	.	3	.	3	[illegible]	20	54	1	1	.	.
BKKPG 2	406	.	.	3	5	2	5	.	.	.	.	.	.	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.	.
TYPING 1	407	5	9	40	80	32	4	4	.	5	8	5	.	6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15	3
SHORT 1	409	.	.	20	54	6	1	.	.	3	6	1	1	5	1	72	2	6	.	2	.
CLER PRAC	411	.	.	.	1	4	59	7	.	.	.	1	.	.	4	1	1	46	4	10	1
COMM LAW	412	.	.	2	3	30	.	4	1	1	.	.	.	.	3	6	.	24	4	8	3
BUS MACH	415	.	.	.	.	7	6	.	.	.	.	.	.	.	.	1	.	6	.	.	.
DIST ED	416	.	.	.	.	4	2	2	.	.	.	.	.	.	.	.	.	5	2	3	.

Original Size: 14 7/8 X 11"

```
BRUNSWICK HIGH   13334456     65-66                  COURSE TALLIES                        WELLESLEY TEST A

COURSE DESC.   NO.         TOTAL     GR 09     GR 10     GR 11     GR 12     OTHER

ENGLISH 2      007            19         .        19         .         .         .
ENGLISH 2      008           118         .        96        11         5         .
ENGLISH 3      013           171         .         1       145         9         .
ENGLISH 3      014           752         .        57       313       124         .
ENGLISH 4      019           958         .        74       154       363         .
ENGLISH 4      020           322         .         1        26       185         .
ENGLISH 4      021           499         .         .       122       170         .
DRAM 1         025           149         .         5        30        46         .
JOURN 1        029            31         .         .        16         7         .
JOURN 2        030            57         .         4        19        17         .

SPEECH 1       033           784         .        17        30       359         .
SPEECH 2       034           736         .        17       346         8         .
DRAM 2         039           248         .       108        20         4         .
DRAM 3         040            27         .         .         .        27         .
U S HIST       103           373         .        11       346        16         .
WRLD GEOG      105            66         .        57         7         2         .
AMER GOVT      106           248         .         1        15       232         .
ECONOMIC       109            32         .         1         1        30         .
GOVT POD       113           139         .         2         7       130         .
POD ECON       116            26         .         .         1        25         .

PL GEOM        205            51         .        44         6         1         .
TRIG           206             8         .         .         2         6         .
SLD GEOM       207             1         .         .         1         .         .
SR MATH        208            27         .         .         2        25         .
GEOM HNR       209            11         .        11         .         .         .
ADV ALG        211           145         .         .       139         6         .
TRIGSDHNR      212            11         .         .        11         .         .
TRIG SOL       213            65         .         .         .        65         .
BIOLOGY        252            26         .        25         1         .         .
BIOLOGY        253            42         .        39         3         .         .

CHEMISTRY      254           125         .         .         .       125         .
PHYSICS        255           151         .         .       142         9         .
SR SCI         256            43         .         1        13        29         .
FRENCH 1       301            28         .         4        22         2         .
FRENCH 2       302            26         .        11         3        12         .
FRENCH 3       303             9         .         .         9         .         .
LATIN 2        306            38         .        38         .         .         .
LATIN 3        307            16         .         .        12         4         .
LATIN 4        308             4         .         .         .         4         .
SPANISH 1      309            32         .         5        20         7         .

SPANISH 2      310            23         .         6         4        13         .
SPANISH 3      311             4         .         .         .         4         .
BKKPG 1        405            76         .        52        23         1         .
BKKPG 2        406            15         .         1         7         7         .
TYPING 1       407           174         .        15       119        40         .
SHORT 1        409            81         .         1        73         7         .
CLER PRAC      411            71         .         .         2        69         .
COMM LAW       412            39         .         .         5        34         .
BUS MACH       415            13         .         .         .        13         .
DIST FD        416             8         .         .         .         8         .
```

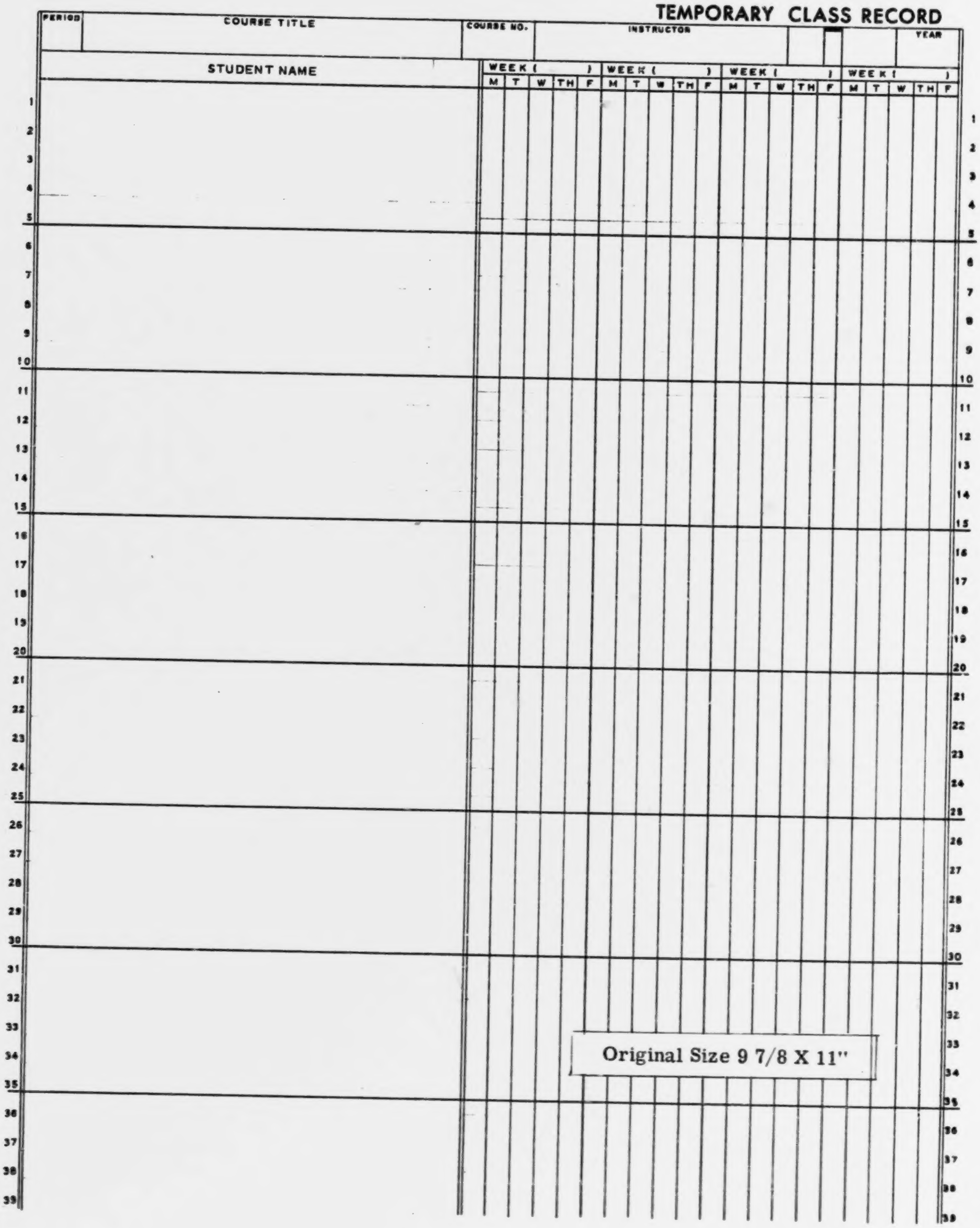
Original Size: 14 7/8 X 11"

List of Courses (Master Schedule List)

	COURSE	SECT	TIME	[illegible]	COURSE-TITLE	TEACHER	ROOM	[illegible]	MIN	MAX	USED	NEW	PCT/USED
	9991	1	A	3	UNSCHED 1ST PER			1	999	999	[illegible]	[illegible]	[illegible]
	9992	[illegible]	[illegible]	3	UNSCHED 2ND PER				999	999	3	996	0
	9993	3	C	3	UNSCHED 3RD PER			3	999	999	[illegible]	[illegible]	0
	9994	4	D	3	UNSCHED 4TH PER			4	999	999	2	[illegible]	[illegible]
	9995	5	E	3	UNSCHED 5TH PER			[illegible]	999	999	2	997	0
	9996	6	F	3	UNSCHED 6TH PER			6	999	999	1	998	0
	9997	7	G	3	UNSCHED.7TH PER			7	999	999	2	997	[illegible]
	9998	8	H1	3	UNSCHED 8TH PER			-00000	999	999	0	999	0
	1011	9	B	3	ENGLISH 1-2 H	COLLINS	085 656	2	24	27	23	4	85
2	1011	10	D	3	ENGLISH 1-2 H	MICKELSON	290 403	4	24	27	23	4	85
	1012	11	A	3	ENGLISH 1-2 X	BENJAMIN	025 656	1	26	31	27	4	87
	1012	12	A	3	ENGLISH 1-2 X	MICKELSON	290 403	1	26	31	27	4	87
	1012	13	B	3	ENGLISH 1-2 X	ROGERS	355 659	2	26	31	28	3	90
7	1012	14	C	3	ENGLISH 1-2 X	COLLINS	085 403	3	26	31	28	3	90
	1012	15	C	3	ENGLISH 1-2 X	WHITE	480 613	3	26	31	28	3	90
	1012	16	F	3	ENGLISH 1-2 X	BENJAMIN	025 656	[illegible]	26	31	28	3	90
	1012	17	G	3	ENGLISH 1-2 X	ROGERS	355 659	7	26	31	28	3	90
	1013	18	A	3	ENGLISH 1-2 Y	COLLINS	085 656	1	29	34	30	4	88
	1013	19	B	3	ENGLISH 1-2 Y	MICKELSON	290 403	2	29	34	31	3	91
	1013	20	B	3	ENGLISH 1-2 Y	BENJAMIN	025 656	2	29	34	31	3	91
	1013	21	C	3	ENGLISH 1-2 Y	ROGERS	355 659	3	29	34	31	3	91
8	1013	22	E	3	ENGLISH 1-2 Y	BENJAMIN	025 650	[illegible]	29	34	31	3	91
	1013	23	F	3	ENGLISH 1-2 Y	ROGERS	355 659	[illegible]	29	34	32	2	94
	1013	24	G	3	ENGLISH 1-2 Y	MICKELSON	290 403	7	29	34	31	3	91
	1013	25	G	3	ENGLISH 1-2 Y	COLLINS	085 405	7	29	34	32	2	94
	1014	26	A	3	ENGLISH 1-2 Z	ROGERS	355 659	1	19	25	20	5	80
3	1014	27	C	3	ENGLISH 1-2 Z	BENJAMIN	025 650	3	19	25	21	4	84
	1014	28	F	3	ENGLISH 1-2 Z	MICKELSON	290 403	6	19	25	21	4	84
	1015	29	C	3	ENGLISH 1-2 R	HILLS	220 303	3	18	23	18	5	78
2	1015	30	F	3	ENGLISH 1-2 R	HILLS	220 303	6	18	23	18	5	78
	1031	31	B	3	ENGLISH 3-4 H	HANNAH	195 406	2	25	29	24	5	82
2	1031	32	F	3	ENGLISH 3-4 H	BOESCH	040 404	6	[illegible]	29	24	5	82
	1032	33	A	3	ENGLISH 3-4 X	HANNAH	195 406	1	29	33	[illegible]	[illegible]	[illegible]
	1032	34	A	3	ENGLISH 3-4 X	ZUIDSMA	515 406	1	[illegible]	[illegible]	[illegible]	4	87
	1032	35	C	3	ENGLISH 3-4 X	BOESCH	040 404	3	29	33	[illegible]	4	87
7	1032	36	E	3	ENGLISH 3-4 X	HARDIE	200 653	5	29	33	29	4	87
	1032	37	F	3	ENGLISH 3-4 X	HARDIE	200 653	6	29	33	[illegible]	4	87
	1032	38	G	3	ENGLISH 3-4 X	HANNAH	195 406	7	29	33	29	4	87
	1032	39	G	3	ENGLISH 3-4 X	BOESCH	040 404	7	29	33	30	3	90
	1033	40	A	3	ENGLISH 3-4 Y	BOESCH	040 404	1	30	33	31	2	93
	1033	41	A	3	ENGLISH 3-4 Y	HARDIE	200 653	1	30	33	31	2	93
	1033	42	B	3	ENGLISH 3-4 Y	HARDIE	200 [illegible]	2	30	33	31	2	93
7	1033	43	C	3	ENGLISH 3-4 Y	ZUIDSMA	515 406	[illegible]	30	33	31	2	93
	1033	44	E	3	ENGLISH 3-4 Y	BOESCH	040 404	[illegible]	30	33	31	2	93
	1033	45	F	3	ENGLISH 3-4 Y	COLLINS	[illegible]	[illegible]	30	[illegible]	33	0	100
	1033	46	G	3	ENGLISH 3-4 Y	CHAVARR	[illegible]	7	30	33	32	1	97
	1034	47	[illegible]	[illegible]	ENGLISH 3-4 Z	HANNAH	[illegible]	[illegible]	27	[illegible]	[illegible]	4	86
	1034	48	F	[illegible]	ENGLISH 3-4 Z	HANNAH	[illegible]	[illegible]	27	[illegible]	26	3	89
3	1034	49	G	[illegible]	ENGLISH 3-4 Z	HARDIE	[illegible]	7	27	29	[illegible]	3	[illegible]
	1051	50	A	[illegible]	ENGLISH 5-6 H	WEATHERINGT	47[illegible] 40[illegible]	1	[illegible]	29	[illegible]	4	[illegible]
2	1051	51	[illegible]	[illegible]	ENGLISH 5-6 H	WEATHERINGT	47[illegible] 40[illegible]	[illegible]	25	[illegible]	[illegible]	5	[illegible]
	1052	[illegible]	[illegible]	[illegible]	ENGLISH 5-6 X	[illegible]	010 [illegible]	1	[illegible]	[illegible]	[illegible]	4	[illegible]7
	1052	[illegible]	[illegible]	[illegible]	ENGLISH 5-6 X	[illegible]	[illegible] 1	[illegible]	[illegible]	33	[illegible]	4	[illegible]7
6	1052	[illegible]	[illegible]	[illegible]	ENGLISH [illegible]	JACKNITZ	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	[illegible]7
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	CLAY	27 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	[illegible]7
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] 1	6	[illegible]	[illegible]	[illegible]	4	[illegible]7
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	CLAY	27 [illegible]0	7	[illegible]	[illegible]	[illegible]	3	[illegible]
	[illegible]	[illegible]	A	[illegible]	[illegible] Y	CLAY	27 [illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]		[illegible] Y	WEATHERINGT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]1
6	[illegible]	[illegible]	[illegible]		[illegible] Y	CLAY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]1	3	[illegible]1
	[illegible]	[illegible]1	C		[illegible] Y	WEATHERINGT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]1	[illegible]	[illegible]1
	[illegible]	[illegible]	[illegible]	[illegible]	ENGLISH [illegible] Y	ALLEN	01 [illegible]1		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Original Size: 14 7/8 X 11"

Class List



TEMPORARY CLASS RECORD

PERIOD	COURSE TITLE	COURSE NO.	INSTRUCTOR				YEAR

	STUDENT NAME	WEEK ( )					WEEK ( )					WEEK ( )					WEEK ( )					
		M	T	W	TH	F	M	T	W	TH	F	M	T	W	TH	F	M	T	W	TH	F	
1																						1
2																						2
3																						3
4																						4
5																						5
6																						6
7																						7
8																						8
9																						9
10																						10
11																						11
12																						12
13																						13
14																						14
15																						15
16																						16
17																						17
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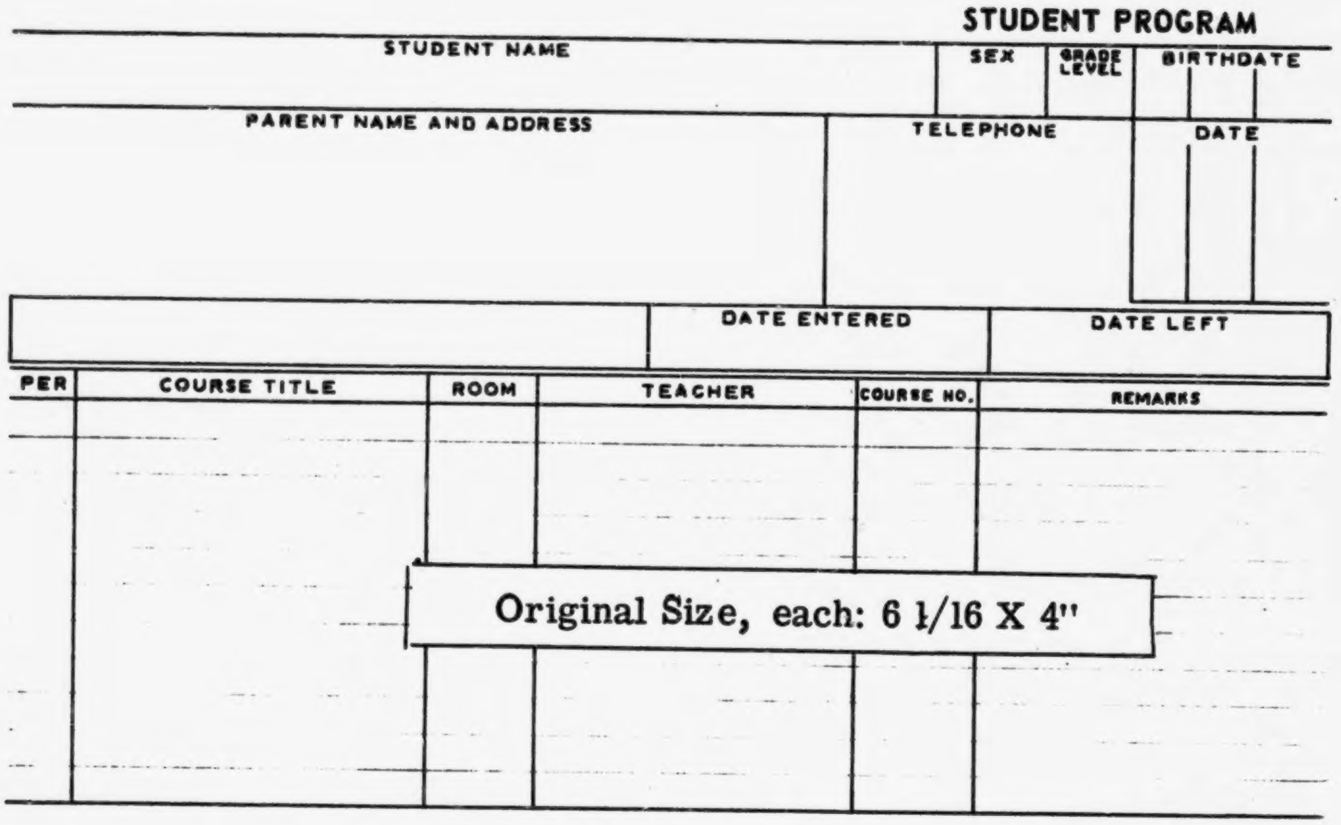
29																						29
30																						30
31																						31
32																						32
33																						33
34																						34
35																						35
36																						36
37																						37
38																						38
39																						39

Original Size 9 7/8 X 11"

Locator Cards



STUDENT PROGRAM

STUDENT NAME	SEX	GRADE LEVEL	BIRTHDATE

PARENT NAME AND ADDRESS	TELEPHONE	DATE

	DATE ENTERED	DATE LEFT

PER	COURSE TITLE	ROOM	TEACHER	COURSE NO.	REMARKS

Original Size, each: 6 1/16 X 4"

ATTENDANCE REGISTER

1

ATTENDANCE CODES

S - ILLNESS OR QUARANTINE

A - ABSENCE OTHER THAN ILLNESS OR QUARANTINE

N - DAYS NOT ENROLLED

I - INSTITUTE

H - HOLIDAY

E/L CODES

E-1: PUPIL ENROLLING FOR THE FIRST TIME IN ANY PUBLIC SCHOOL THIS YEAR

E-2: PUPIL ENROLLING FOR THE FIRST TIME IN A CALIFORNIA SCHOOL THIS YEAR

E-3: PUPIL ENROLLING AS A TRANSFER

R: PUPIL RETURNING TO THE SAME SCHOOL

L: TRANSFERS

TEACHER OR AUTHORIZED EMPLOYEE

SCHOOL NAME

ATT. CAT.

SCHOOL CODE

SCHOOL MONTH

GRADE	M/F	PUPILS NAME			E/L	FIRST WEEK					SECOND WEEK					THIRD WEEK					FOURTH WEEK					DAYS NOT ENROLLED	ABSENCE OTHER THAN ILLNESS	APPORTION-MENT	DAYS TAUGHT
		BOYS	GIRLS	TOTAL		M	T	W	TH	F	M	T	W	TH	F	M	T	W	TH	F	M	T	W	TH	F				
TOTAL BY GRADE					A. D. A. BY GRADE																TOTALS BY GRADE								
TOTAL					TOTAL A. D. A.																TOTAL								

Original Size: 12 1/8 X 8 1/2"

IRREGULAR ATTENDANCE ANALYSIS

SCHOOL NAME

SCHOOL ADDRESS

– –
DATE OF ATTENDANCE PER

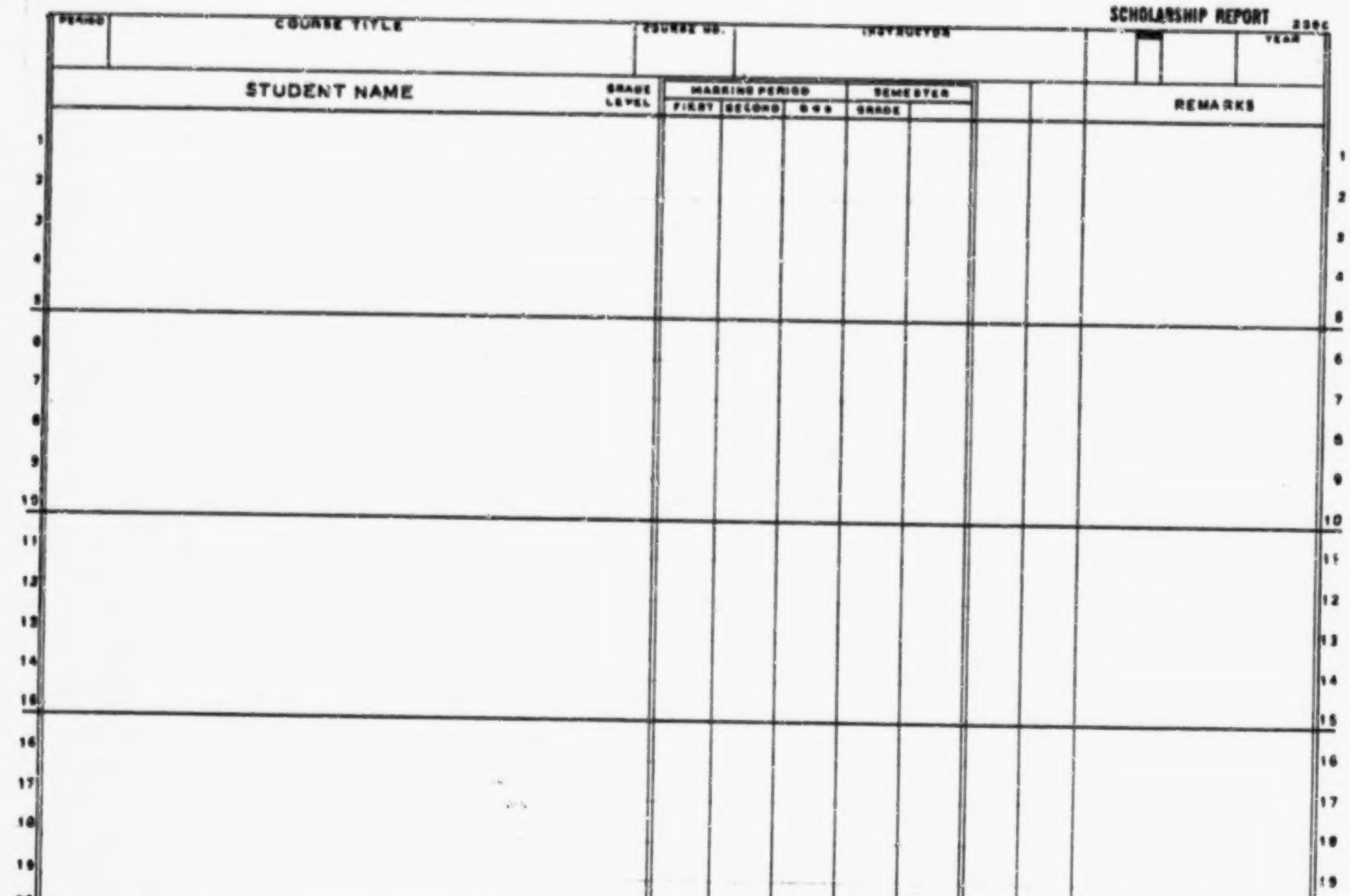
COUNSELOR

STUDENT IDENTIFICATION	ABSENCES THIS		PATTERN					RELATED FACTORS					NOTES
	MONTH	YEAR	M	T	W	T	F	APT	READ	ARITH	LANG	CURRENT GPA	

PRINT ALIGN MARK ↔

PRINTED BY THE STANDARD REGISTER COMPANY USA

Original Size: 12 13/16 X 8 1/2"



SCHOLARSHIP REPORT

PERIOD	COURSE TITLE	COURSE NO.	INSTRUCTOR		YEAR

STUDENT NAME	GRADE LEVEL	MARKING PERIOD FIRST	MARKING PERIOD SECOND		SEMESTER GRADE				REMARKS
1									1
2									2
3									3
4									4
5									5
6									6
7									7
8									8
9									9
10									10
11									11
12									12
13									13
14									14
15									15
16									16
17									17
18									18
19									19
20									20
21									21
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23									23
24									24
25									25
26									26
27									27
28									28
29									29
30									30
31									31
32									32
33									33
34									34
35									35
36									36
37									37
38									38
39									39

Original Size: 9 7/8 X 11"

MARK ANALYSIS

1

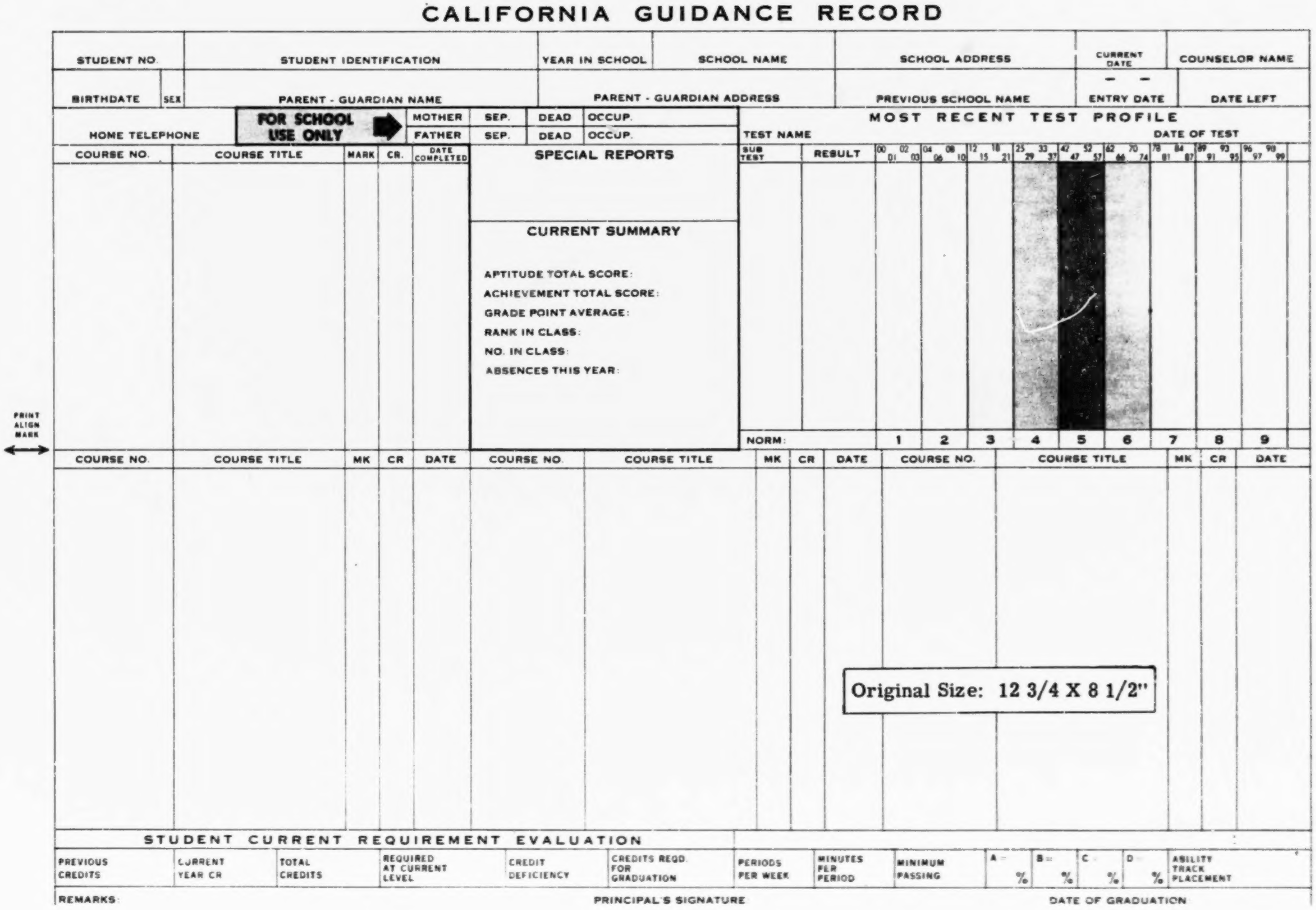
SCHOOL NAME

MARKING DATE

GRADE	STUDENT NO	STUDENT NAME		NUMBER OF MARKS					MARK PERCENTAGES					
TEACHER NO	PD COURSE # AND GROUP	TEACHER NAME	COURSE TITLE	#A's	#B's	#C's	#D's	#F's	%A's	%B's	%C's	%D's	%F's	GRADE POINT AVG

Original Size: 9 1/2 X 11"

Speedflo ® Moore Business Forms, Inc. ©



CALIFORNIA GUIDANCE RECORD

STUDENT NO.		STUDENT IDENTIFICATION	YEAR IN SCHOOL	SCHOOL NAME	SCHOOL ADDRESS	CURRENT DATE	COUNSELOR NAME
BIRTHDATE	SEX	PARENT - GUARDIAN NAME	PARENT - GUARDIAN ADDRESS		PREVIOUS SCHOOL NAME	– – ENTRY DATE	DATE LEFT

HOME TELEPHONE	FOR SCHOOL USE ONLY ➡	MOTHER	SEP.	DEAD	OCCUP.
		FATHER	SEP.	DEAD	OCCUP.

COURSE NO.	COURSE TITLE	MARK	CR.	DATE COMPLETED

SPECIAL REPORTS

CURRENT SUMMARY

APTITUDE TOTAL SCORE:
ACHIEVEMENT TOTAL SCORE:
GRADE POINT AVERAGE:
RANK IN CLASS:
NO. IN CLASS:
ABSENCES THIS YEAR:

MOST RECENT TEST PROFILE

TEST NAME

DATE OF TEST

SUB TEST	RESULT	00 01 02 03	04 06 08 10	12 15 18 21	25 29 33 37	42 47 52 57	62 66 70 74	78 81 84 87	89 91 93 95	96 97 98 99	
NORM:		1	2	3	4	5	6	7	8	9	

COURSE NO.	COURSE TITLE	MK	CR	DATE	COURSE NO.	COURSE TITLE	MK	CR	DATE	COURSE NO.	COURSE TITLE	MK	CR	DATE

Original Size: 12 3/4 X 8 1/2"

STUDENT CURRENT REQUIREMENT EVALUATION

PREVIOUS CREDITS	CURRENT YEAR CR	TOTAL CREDITS	REQUIRED AT CURRENT LEVEL	CREDIT DEFICIENCY	CREDITS REQD. FOR GRADUATION	PERIODS PER WEEK	MINUTES PER PERIOD	MINIMUM PASSING	A = %	B = %	C = %	D = %	ABILITY TRACK PLACEMENT

REMARKS:

PRINCIPAL'S SIGNATURE

DATE OF GRADUATION

PRINT ALIGN MARK ↔

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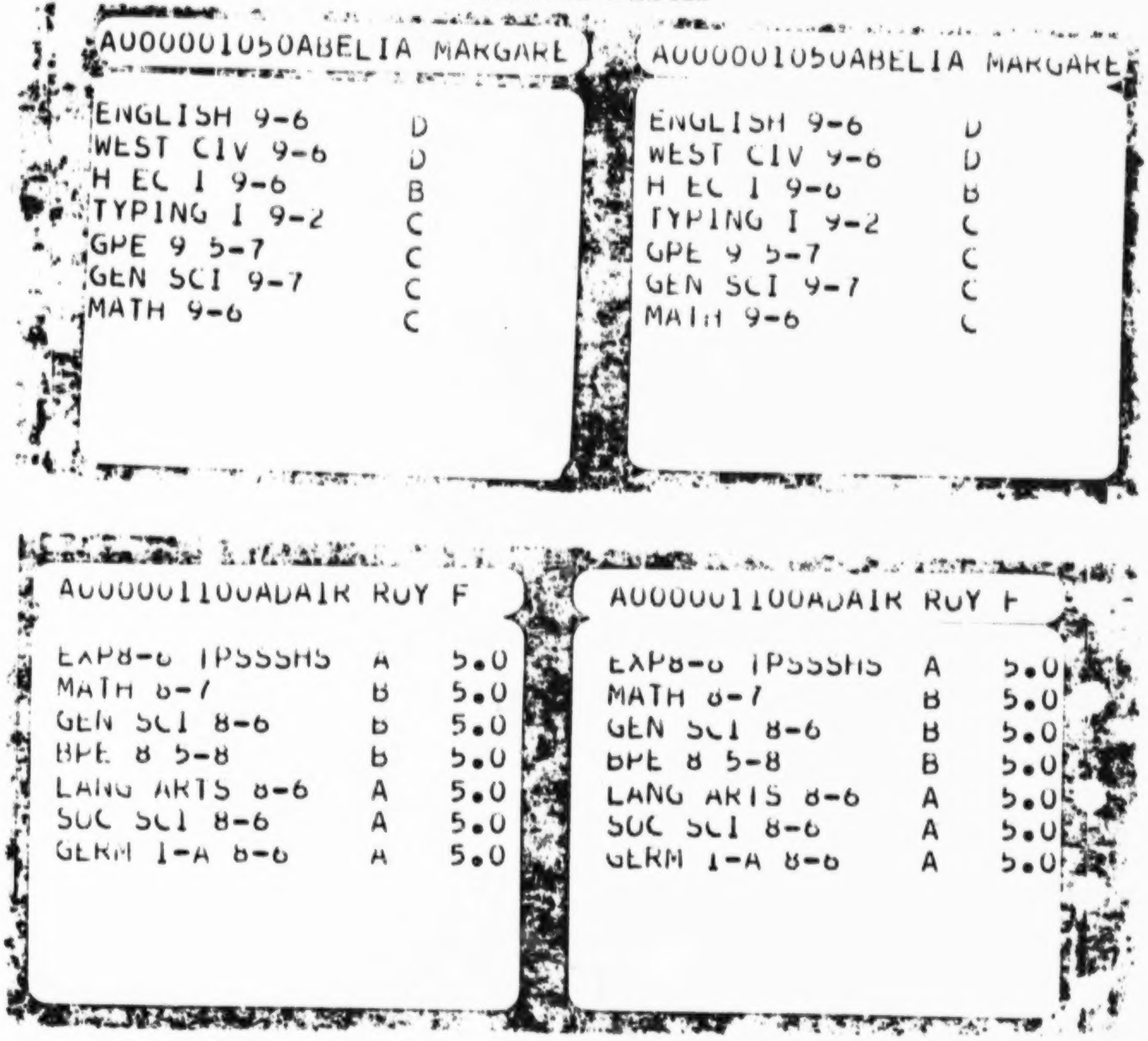
Gummed Labels



```
A000001050ABELIA MARGARE

ENGLISH 9-6          D
WEST CIV 9-6         D
H EC I 9-6           B
TYPING I 9-2         C
GPE 9 5-7            C
GEN SCI 9-7          C
MATH 9-6             C
```

```
A000001050ABELIA MARGARE

ENGLISH 9-6          D
WEST CIV 9-6         D
H EC I 9-6           B
TYPING I 9-2         C
GPE 9 5-7            C
GEN SCI 9-7          C
MATH 9-6             C
```

```
A000001100ADAIR ROY F

EXP8-6 IPSSSHS    A    5.0
MATH 8-7          B    5.0
GEN SCI 8-6       B    5.0
BPE 8 5-8         B    5.0
LANG ARTS 8-6     A    5.0
SOC SCI 8-6       A    5.0
GERM I-A 8-6      A    5.0
```

```
A000001100ADAIR ROY F

EXP8-6 IPSSSHS    A    5.0
MATH 8-7          B    5.0
GEN SCI 8-6       B    5.0
BPE 8 5-8         B    5.0
LANG ARTS 8-6     A    5.0
SOC SCI 8-6       A    5.0
GERM I-A 8-6      A    5.0
```

Same Size

REGIONAL EDUCATIONAL DATA PROCESSING CENTER

ROSTER OF TEST RESULTS

ABILITY SCORES

STUDENT IDENTIFICATION

GRADE

SCHOOL NAME

GROUP NO.

PAGE NO.

— —

DATE

ACHIEVEMENT SUBTEST IDENTITY

1

Original Size: 11 3/4 X 81/2"

PROFILE OF TEST RESULTS

DATE

STUDENT IDENTIFICATION

MOST RECENT TEST PROFILE

TEST NAME

DATE OF TEST

SUB TEST	RESULT	00 02 01 03	04 08 06 10	12 18 15 21	25 33 29 37	42 52 47 57	62 70 66 74	78 84 81 87	89 93 91 95	96 98 97 99
NORM		1	2	3	4	5	6	7	8	9
		LOW	BELOW AVERAGE		AVERAGE			ABOVE AVERAGE		HIGH

NOTES

Original Size: 12 X 8 1/2"

PRINT ALIGN MARK ↔

PRINTED BY THE STANDARD REGISTER COMPANY, U.S.A.

EDUCATIONAL PLANNING REPORT

DATE
DISTRICT
APTITUDE TEST
ACHIEVEMENT TEST

	APTITUDE			ACHIEVEMENT				MARK AVERAGE BY AREA				REMARKS
	LANG	NON LANG	TOTAL	LANG	READ	ARITH	TOTAL	LANG ARTS	MATH	SOC SCI	TOTAL GPA	

EXPLANATION OF STANINE SCORES	
1	LOW
2-3	BELOW AVERAGE
4-5-6	AVERAGE
7-8	ABOVE AVERAGE
9	HIGH

Original Size: 12 7/8 X 8 1/2"

PRINTED BY THE STANDARD REGISTER COMPANY, U.S.A.

Unsuccessful Scheduling Attempts

```
[illegible]

[illegible] MINIMUM SEATS FULL [illegible]                 [illegible] STUDENTS PROCESSED.[illegible]

CLASS [illegible] MINIMUM SEATS FULL # EXP SCP [illegible]         4[illegible]  STUDENTS PROCESSED.11[illegible]

CLASS [illegible] CLOSED            # EXP SCH NO[illegible]         4[illegible]  STUDENTS PROCESSED.11[illegible]

CLASS [illegible] MINIMUM SEATS FULL ST FALL     A         374  STUDENTS PROCESSED.12[illegible]

CLASS 2740 MINIMUM SEATS FULL [illegible] 4     F         407  STUDENTS PROCESSED.12[illegible]

CLASS 8001 MINIMUM SEATS FULL ELEC [illegible] 1 [illegible]A         374  STUDENTS PROCESSED.121[illegible]

     COMBINATIONS EXHAUSTED FOR
0512220062MCCOY JAMES         LOADING  GOOD  TRY=     0 STOPPED AT LEVEL. 6 SEQ= 1219
     COURSE A B C D E F G   N   COURSE TITLE  LEVEL      A B C D E F G
PER CLOCK   0 0 0 0 0 0 0  SEC
     9993   0 0 0 0 0 0 0   1   UNSCHED SPG PER  1       0 0 0 0 0 0 0
     1213   0 0 0 0 0 0 0   1   MOD LIT 1-2 2    2       0 0 0 0 0 0 0
     2213   0 0 0 0 0 0 0   1   GOVT ACT 1-2 7   3       0 0 0 0 0 0 0
     4070   0 0 0 0 0 0 0   5   ECYS F[illegible] 7-[illegible]       4       0 0 0 0 0 0 0
     2552   0 0 0 0 0 0 0   1   AUT MEC [illegible]      5       0 0 0 0 0 0 0
     9601   0 0 0 0 0 0 0   4   LUNCH            6       0 0 0 0 0 0 0
COURSE 9601 DELETED

CLASS 9605 MINIMUM SEATS FULL # EXP SCI [illegible]         515  STUDENTS PROCESSED.12[illegible]

CLASS 9605 CLOSED             # EXP SCH G G         516  STUDENTS PROCESSED.1234

CLASS 9606 MINIMUM SEATS FULL # EXP SCP LID         494  STUDENTS PROCESSED.1244

CLASS 9604 MINIMUM SEATS FULL # EXP SCH NO[illegible]         488  STUDENTS PROCESSED.125[illegible]

CLASS 9604 CLOSED             # EXP SCH NOE         489  STUDENTS PROCESSED.1259

CLASS 7210 MINIMUM SEATS FULL TYPING 1     G         333  STUDENTS PROCESSED.1260

CLASS 9604 MINIMUM SEATS FULL # EXP SCP NO[illegible]         487  STUDENTS PROCESSED.1260

CLASS 9604 CLOSED             # EXP SCH NO[illegible]         487  STUDENTS PROCESSED.1260

CLASS 9604 MINIMUM SEATS FULL # EXP SCH NO[illegible]         48[illegible]  STUDENTS PROCESSED.12[illegible]

CLASS 9604 CLOSED             # EXP SCP NOH         48[illegible]  STUDENTS PROCESSED.12[illegible]

CLASS 9607 MINIMUM SEATS FULL ST FALL      A         570  STUDENTS PROCESSED.1264

CLASS 9602 MINIMUM SEATS FULL LUNCH - [illegible]    G         [illegible]  STUDENT  PROCESSED.12[illegible]4

     COMBINATIONS EXHAUSTED FOR
0512[illegible]MCNEIL PATTY   [illegible]  GOOD  TRY=   [illegible] STOPPED AT LEVEL. [illegible] SEQ= 12[illegible]
     COURSE A B C [illegible]   N   COURSE TITLE  LEVEL      [illegible]
PER CLOCK   0 [illegible]
     [illegible]   [illegible]   [illegible]   [illegible] LIT 1-[illegible]   1       [illegible] 0 0
     12[illegible]   [illegible]   [illegible]   [illegible]A [illegible]            [illegible] 0 0 [illegible] 0 0 0
     14[illegible]   [illegible]   [illegible]   READING [illegible]             [illegible] 0 0 0
     [illegible]1   [illegible]   [illegible]   GOVT [illegible]     4       [illegible] 0
     [illegible]   [illegible]   1   [illegible]      5       [illegible] 0
     [illegible]   [illegible]   [illegible]   [illegible]      6       [illegible] 0
     [illegible]   [illegible]          7       [illegible] 0
     [illegible]

     [illegible] MINIMUM [illegible]      1 [illegible]              [illegible] PROCESSED.1[illegible]

[illegible]              [illegible] 4 1-              4[illegible]  STU[illegible]  [illegible]
```

Original Size: 14 7/8 X 11"

TAPE FILE RECORD FORMATS

Tape File Name Page

Student Master File 91

Student Schedule 92

School Master Schedule 93

Attendance Gathering Tape 94

Calendar Tape 95

Preliminary Grade Reporting Tape 96

Grade Reporting Tape 97

Decoded Mark Reporting Tape 98

F&I-GPA Tape 99

Student History File 100

Test Score Tape 101

DETAIL
MEMORY LAYOUT

Student Master File

Honeywell
ELECTRONIC DATA PROCESSING

PROGRAM ______ PROGRAMMER ______ DATE ______ REV NO ______ PAGE ____ OF ____

SYMBOLIC	SCHOOL NO.	STUDENT NO.	ATTENDANCE		STUDENT NAME	STUDENT'S RESIDENCE ADDRESS			FLAGS
DATA ITEM MARK WORD MARK LOCATION			NEXT MO	PRIOR MO		STREET	CITY	ZIP	SEX GRADE

SYMBOLIC	TELEPHONE			BIRTH DAY		BIRTH VER.	BIRTHPLACE	LAST SCHOOL			PREVIOUS DISTRICT NAME	PREVIOUS RESIDENCE CITY		DATE ENTERED	DATE LEFT		PARENT TITLE	PARENT OR GUARDIAN NAME
DATA ITEM MARK WORD MARK LOCATION	AREA CODE	PREFIX	SUFFIX	MONTH DAY	YEAR			COUNTY	DISTRICT	SCHOOL			ENTRY CODE			LEAVE CODE		

SYMBOLIC	PARENT OR GUARDIAN ADDRESS (IF DIFFERENT FROM STUDENT)			FATHER'S OCCUPATION	MOTHER'S OCCUPATION	31 RELATED	COUNSELOR'S NAME	MONTHLY ATTENDANCE PICTURE				YEARLY
DATA ITEM MARK WORD MARK LOCATION	STREET	CITY	ZIP					WEEK 1	WEEK 2	WEEK 3	WEEK 4	

SYMBOLIC	ATTENDANCE	TOTAL YEARLY ABSENCES	1ST COURSE	2ND COURSE	3RD COURSE	4TH COURSE	5TH COURSE	6TH COURSE	7TH COURSE	8TH COURSE	ACHIEVEMENT TEST	1ST
DATA ITEM MARK WORD MARK LOCATION	WEDS. THURS. FRIDAY	EXCUSED UNEXCUSED ENROLLED	SEQ NO MARK 1 MARK 2 MARK 3 SEM. MK.	SEQ NO MARK 1 MARK 2 MARK 3 SEM. MK.	SEQ NO MARK 1 MARK 2 MARK 3 SEM. MK.	SEQ NO MARK 1 MARK 2 MARK 3 SEM. MK.	SEQ NO MARK 1 MARK 2 MARK 3 SEM. MK.	SEQ NO MARK 1 MARK 2 MARK 3 SEM. MK.	SEQ NO MARK 1 MARK 2 MARK 3 SEM. MK.	SEQ NO MARK 1 MARK 2 MARK 3 SEM. MK.	TEST ID FORM LEVEL DATE AND GRADE NORM	SUB SCORE SUB

SYMBOLIC	2ND	3RD		4TH		5TH		6TH		7TH		8TH		9TH		10TH		APTITUDE TEST					LANGUAGE	
DATA ITEM MARK WORD MARK LOCATION	SCORE	SUB	SCORE	SUB	SCORE	SUB	SCORE	SUB	SCORE	SUB	SCORE	SUB	SCORE	SUB	SCORE	SUB	SCORE	TEST ID	FORM	LEVEL	DATE AND GRADE	NORM		

SYMBOLIC	VERBAL		TOTAL			COURSE CHANGES		GPA		RECORD CONTAINS 533 CHARACTERS
DATA ITEM MARK WORD MARK LOCATION					ROOM NUMBER	PAGE	LINE		SORT ROOM NUMBER	

SYMBOLIC	
DATA ITEM MARK WORD MARK LOCATION	

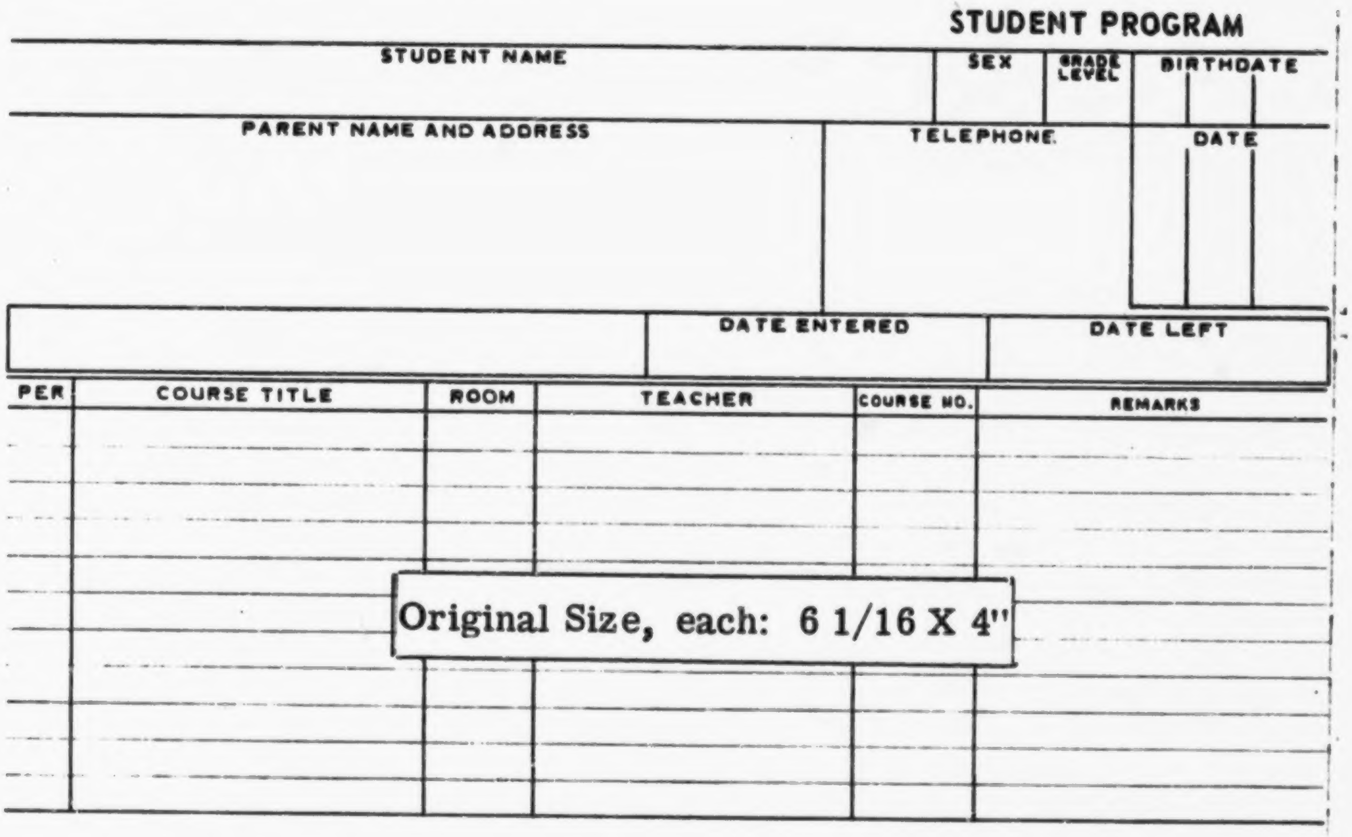
SYMBOLIC	
DATA ITEM MARK WORD MARK LOCATION	

SYMBOLIC	
DATA ITEM MARK WORD MARK LOCATION	

SYMBOLIC	
DATA ITEM MARK WORD MARK LOCATION	

Original Size: 17 X 11"

Student Schedule Card



STUDENT PROGRAM

STUDENT NAME | SEX | GRADE LEVEL | BIRTHDATE

PARENT NAME AND ADDRESS | TELEPHONE | DATE

DATE ENTERED | DATE LEFT

PER	COURSE TITLE	ROOM	TEACHER	COURSE NO.	REMARKS

Original Size, each: 6 1/16 X 4"

School Master Schedule

```
8  [illegible] 12[illegible]  [illegible]     [illegible]              [illegible]  [illegible]  [illegible]  [illegible]  36  3  76
   2112 1[illegible]             AM HIST 1-2 Y       THOMPSON   4[illegible]                  1[illegible]  3[illegible]  96
   2112 131                      AM HIST 1-2 Y       McNEALY    1[illegible] [illegible]1                                   1[illegible]
   2112 132 C                    AM HIST 1-2 Y       NICHOLAS   [illegible]   7     2  [illegible]3  36  3  96
   2112 13[illegible]        3   AM HIST 1-2 Y       THOMPSON   4[illegible]  7     [illegible]  3  3[illegible]  3  90
2  2114 134 A                    AM HIST 1-2 Z       THOMPSON   4[illegible]  1    31  4  [illegible]  5  80
   2114 135                  3   AM HIST 1-2 Z       NICHOLAS   30[illegible] [illegible]7   31  [illegible]  29  [illegible]  76
6  2211 136 [illegible]          GOVT ACT 1-2 X      SMITH      3[illegible] 40[illegible] 1   [illegible]  35  34  2  94
   2211 137 B                    GOVT ACT 1-2 X      SMITH      [illegible] 405  2   [illegible]  [illegible]  [illegible]  4  [illegible]
   2211 138 B                    GOVT ACT 1-2 X      HAMPEL     190 204  [illegible]  [illegible]  36  32  4  88
   2211 139 C                    GOVT ACT 1-2 X      ENOCHS     130 20[illegible]  3   32  36  33  3  91
   2211 140 C                3   GOVT ACT 1-2 X      HAMPEL     190 204  4   32  36  33  3  91
   2211 141 G                    GOVT ACT 1-2 X      ENOCHS     130 20[illegible]  7   32  36  34  2  94
6  2212 142 A                    GOVT ACT 1-2 Y      HAMPEL     190 204  1   28  31  27  4  87
   2212 143 B                3   GOVT ACT 1-2 Y      ENOCHS     130 20[illegible]  2   28  31  26  5  83
   2212 144 C                3   GOVT ACT 1-2 Y      SMITH      395 405  3   28  31  27  4  87
   2212 145 D                3   GOVT ACT 1-2 Y      SMITH      395 405  4   28  31  26  5  83
   2212 146 F                3   GOVT ACT 1-2 Y      SMITH      395 [illegible]  6   28  31  28  3  90
   2212 147 G                3   GOVT ACT 1-2 Y      HAMPEL     190 204  7   2[illegible]  31  29  2  93
1  2212 148 E                3   GOVT ACT 1-2        HAMPEL     190 204  5   31  3[illegible]  31  [illegible]  [illegible]
4  3010 149 A                3   PRACT MATH 1-2      HALL       185 701  1   20  2[illegible]  23  5  82
   3010 150 B                3   PRACT MATH 1-2      HALL       185 701  2   20  28  23  [illegible]  82
   3010 151 C                3   PRACT MATH 1-2      CARLTON    005 301  5   20  28  22  6  78
   3010 152 F                3   PRACT MATH 1-2      PARSONS    530 [illegible]12  6   20  2[illegible]  22  6  78
13 3110 153 A                3   GEN MATH 1-2        MORRISON   330 411  1   35  35  33  2  94
   3110 154 A                3   GEN MATH 1-2        PARSONS    530 621  1   30  35  33  2  94
   3110 155 B                3   GEN MATH 1-2        LEITNER    200 323  2   30  35  33  2  94
   3110 156 C                3   GEN MATH 1-2        TOP        445 621  3   30  35  31  4  88
   3110 157 C                3   GEN MATH 1-2        STANFIELD  400 619  3   30  35  31  4  88
   3110 158 C                3   GEN MATH 1-2        LEITNER    200 [illegible]  3   30  35  32  3  91
   3110 159 E                3   GEN MATH 1-2        MORRISON   330 411  5   30  35  34  1  97
   3110 160 F                3   GEN MATH 1-2        DE WOLF    105 413  6   30  35  34  1  97
   3110 161 G                3   GEN MATH 1-2        STANFIELD  400 619  7   30  35  32  3  91
1  3211 162 F                3   ALGEBRA 1-2H        STANFIELD  400 619  6   27  32  29  3  90
12 3212 163 A                3   ALGEBRA 1-2         SIMMONS    390 613  1   30  35  31  4  88
   3212 164 A                3   ALGEBRA 1-2         DE WOLF    105 413  1   30  35  31  4  88
   3212 165 A                3   ALGEBRA 1-2         STANFIELD  400 619  1   30  35  31  4  88
   3212 166 B                3   ALGEBRA 1-2         TOP        445 621  2   30  35  32  3  91
   3212 167 B                3   ALGEBRA 1-2         JENKINS    240 617  2   30  35  32  3  91
   3212 168 B                3   ALGEBRA 1-2         MORRISON   330 411  2   30  35  32  3  91
   3212 169 C                3   ALGEBRA 1-2         JENKINS    240 517  3   30  35  32  3  91
   3212 170 C                3   ALGEBRA 1-2         PARSONS    530 653  3   30  35  32  3  91
   3212 171 D                3   ALGEBRA 1-2         PARSONS    530 653  4   30  35  32  3  91
   3212 172 E                3   ALGEBRA 1-2         TOP        445 621  5   30  35  32  3  91
   3212 173 F                3   ALGEBRA 1-2         LEITNER    200 [illegible]  6   30  35  32  3  91
   3212 174 G                3   ALGEBRA 1-2         DE WOLF    105 413  7   30  35  32  3  91
1  3311 175 A                3   GEOMETRY 1-2 H      JENKINS    240 517  1   23  27  20  7  74
9  3312 176 A                3   GEOMETRY 1-2        LEITNER    200 613  1   28  35  28  7  80
   3312 177 B                3   GEOMETRY 1-2        STANFIELD  400 619  [illegible]  28  35  28  7  80
   3312 178 B                    GEOMETRY 1-2        PARSONS    530 321  [illegible]  28  35  28  7  80
   3312 179 C                3   GEOMETRY 1-2        MORRISON   [illegible] 411  3   [illegible]  35  30  5  85
   3312 180 C                3   GEOMETRY 1-2        LEITNER    [illegible]  5   28  35  [illegible]
   3312 181 F                    GEOMETRY 1-2        TOP        [illegible] 621  [illegible]  2[illegible]  35
   3312 182 F                    GEOMETRY 1-2        MORRISON   [illegible] 411  6   2[illegible]  35
   3312 183 [illegible]          GEOMETRY 1-2        [illegible]  445 621  7   2[illegible]  35  2[illegible]  [illegible]  [illegible]
   3312 184 [illegible]          GEOMETRY 1-2        JENKINS    240 617  7   2[illegible]  35  3[illegible]  5  85
1  3411 1[illegible]             ADV ALG 1-2         [illegible]  10 412  [illegible]  16  27  2[illegible]  1  [illegible]
3  3412 1[illegible]         3   ADV ALG 1-2         DE WOLF    10[illegible] 41[illegible]  [illegible]  35  29  34  5  87
   3412 1[illegible]             ADV ALG 1-[illegible]  JENKINS  240 617  [illegible]  35  2[illegible]  35  4  [illegible]
   3412 [illegible]          3   [illegible]         SIMMONS    390 613  [illegible]  30  [illegible]  2[illegible]  11  71
   [illegible]        [illegible]                    SIMMONS    [illegible] [illegible]  [illegible]  [illegible]  2[illegible]  4  7[illegible]
2  [illegible]                                       SIMMONS    [illegible] 1  [illegible]  [illegible]  [illegible]  [illegible]0  1  [illegible]
1       1[illegible]                                 SIMMONS    [illegible] [illegible]1  [illegible]  [illegible]  [illegible]  [illegible]1
5  [illegible] 1[illegible] A                 1-2    GONZALEZ   1[illegible] 800  1   [illegible]7  4[illegible]
   [illegible] 1[illegible]                   1-     FARRELL    [illegible] 800  2   37  4[illegible]  [illegible]  8  [illegible]
   [illegible] [illegible]                    1-2    FARRELL    3[illegible] 800  [illegible]  37  4[illegible]  [illegible]  8  [illegible]2
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Original Size: 14 7/8 X 11"

DETAIL
MEMORY LAYOUT

Attendance Gathering Tape

Honeywell
ELECTRONIC DATA PROCESSING

PROGRAM ______ PROGRAMMER ______ DATE ______ REV NO ______ PAGE ______ OF ______

INPUT. ATTENDANCE GATHERING CARD. TRANSCRIBE IMAGE 1. COLUMNS 1-80, ROWS 4-9	SYMBOLIC	CARD CODE	COUNTY	PAGE	DISTRICT	MONTH	SCHOOL	PUPIL 1			PUPIL 2			PUPIL 3			PUPIL 4			PUPIL 5			PUPIL 6			PUPIL 7			PUPIL 8			PUPIL 9			PUPIL 10			PUPIL 11			PUPIL 12		
	DATA ITEM MARK WORD MARK LOCATION							ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE

INPUT. ATTENDANCE GATHERING CARD. TRANSCRIBE IMAGE 2. COLUMNS 1-80, ROWS R-3.	SYMBOLIC	CARD CODE	COUNTY	PAGE	DISTRICT	MONTH	SCHOOL	PUPIL 1			PUPIL 2			PUPIL 3			PUPIL 4			PUPIL 5			PUPIL 6			PUPIL 7			PUPIL 8			PUPIL 9			PUPIL 10			PUPIL 11			PUPIL 12		
	DATA ITEM MARK WORD MARK LOCATION							ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE	ILL	ABS	NE

	SYMBOLIC	
	DATA ITEM MARK WORD MARK LOCATION	

	SYMBOLIC	
	DATA ITEM MARK WORD MARK LOCATION	

OUTPUT. ATTENDANCE GATHERING TRANSACTION RECORD.	SYMBOLIC	COUNTY	DISTRICT	SCHOOL	PAGE	PUPIL 1				PUPIL 2				PUPIL 3				PUPIL 4					
	DATA ITEM MARK					WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 1	WK
	WORD MARK LOCATION					M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W

	SYMBOLIC	PUPIL 5			PUPIL 6				PUPIL 7				PUPIL 8				PUPIL 9					
	DATA ITEM MARK	2	WEEK 3	WEEK 4	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 1	WK
	WORD MARK LOCATION	T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W

	SYMBOLIC				PUPIL 11				PUPIL 12				
	DATA ITEM MARK	2	WEEK 3	WEEK 4	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 1	WEEK 2	WEEK 3	WEEK 4	
	WORD MARK LOCATION	T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	M T W T F	

	SYMBOLIC	
	DATA ITEM MARK WORD MARK LOCATION	

	SYMBOLIC	
	DATA ITEM MARK WORD MARK LOCATION	

Original Size: 17 X 11"

	SYMBOLIC	
	DATA ITEM MARK WORD MARK LOCATION	

DETAIL
MEMORY LAYOUT

1010

Calendar Tape

Honeywell
ELECTRONIC DATA PROCESSING

PROGRAM ______ PROGRAMMER ______ DATE ______ REV NO ______ PAGE ______ OF ______

ATTENDANCE REGISTER: SCHOOL LABEL RECORD.

SYMBOLIC	1			0		SCHOOL CALENDER				SCHOOL NAME	DISTRICT NAME	0------------------------0
DATA ITEM MARK WORD MARK LOCATION		COUNTY	DISTRICT	SCHOOL	MONTH	WEEK 1 M T W T F	WEEK 2 M T W T F	WEEK 3 M T W T F	WEEK 4 M T W T F			

ATTENDANCE REGISTER: STUDENT DATA RECORD.

SYMBOLIC	1						STUDENT NAME			ATTENDANCE								0-------------0
DATA ITEM MARK WORD MARK LOCATION		COUNTY	DISTRICT	SCHOOL	CATEGORY	GRADE OR ROOM (SEC. ELEM.)		SEX	ENTER OR LEAVE	WEEK 1 M T W T F	WEEK 2 M T W T F	WEEK 3 M T W T F	WEEK 4 M T W T F	ABSENT	NOT ENROLLED	APPORT. DAYS	DAYS TAUGHT	

SYMBOLIC	
DATA ITEM MARK WORD MARK LOCATION	

SYMBOLIC	
DATA ITEM MARK WORD MARK LOCATION	

ATTENDANCE REGISTER: SCHOOL TOTAL RECORD.

SYMBOLIC	2					0---0	DISTRICT NAME	NUMBER OF BOYS	NUMBER OF GIRLS	SICK	ABSENT	NOT ENROLLED	APPORT. DAYS	SCHOOL NAME
DATA ITEM MARK WORD MARK LOCATION		COUNTY	DISTRICT	CATEGORY	SCHOOL									

SYMBOLIC	
DATA ITEM MARK WORD MARK LOCATION	

IRREGULAR ATTENDANCE ANALYSIS: SCHOOL LABEL RECORD.

SYMBOLIC	3				0------------------------------0	SCHOOL NAME	DISTRICT NAME	0--------------------0
DATA ITEM MARK WORD MARK LOCATION		COUNTY	DISTRICT	SCHOOL				

IRREGULAR ATTENDANCE ANALYSIS: STUDENT DATA RECORD.

SYMBOLIC	3				COUNSELOR NAME		STUDENT NAME	YTD TOTALS									GPA			0-0
DATA ITEM MARK WORD MARK LOCATION		COUNTY	DISTRICT	SCHOOL		GRADE		M	T	W	T	F	SICK + ABSENT	ARITH.	READ	LANG.		APTITUDE	SEX	

SYMBOLIC	
DATA ITEM MARK WORD MARK LOCATION	

Original Size: 17 X 11"

SYMBOLIC	
DATA ITEM MARK WORD MARK LOCATION	

EDP 1862(12/63)

DETAIL
MEMORY LAYOUT

PROGRAM ______ PROGRAMMER ______ DATE ______ REV NO ______ PAGE ______ OF ______

1010

Preliminary Grade Reporting Tape

Honeywell
ELECTRONIC DATA PROCESSING

SCHOOL LABEL HEADER CONDENSED STUDENT FILE OUTPUT GR 190 INPUT GR 200	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	SCHOOL NO. COUNTY	DISTRICT	SCHOOL	0----------0	SCHOOL NAME	ROOM CODE	SPACES

	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	SPACES

	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	RECORDS ARE 114CHARACTERS IN LENGTH

STUDENT RECORD CONDENSED STUDENT FILE OUTPUT GR 190 INPUT GR 200	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	SCHOOL NO. COUNTY	DISTRICT	SCHOOL	STUDENT NO.	STUDENT NAME	GRADE LEVEL	COUNSELOR	ROOM NUMBER	1ST COURSE SEC. #	MARK 1 MARK 2 MARK 3 SEM. MK	2ND COURSE SEC. #	MARK 1 MARK 2 MARK 3 SEM. MK	3RD COURSE SEC. #	MARK 1 MARK 2 MARK 3 SEM. MK	4TH COURSE SEC. #	MARK 1 MARK 2 MARK 3 SEM. MK

		5TH COURSE SEC. #	MARK 1 MARK 2 MARK 3 SEM. MK	6TH COURSE SEC. #	MK	MARK 1 MARK 2 MARK 3

	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	SEM. MK	7TH COURSE SEC. #	MARK 1 MARK 2 MARK 3 SEM. MK	8TH COURSE SEC. #	MARK 1 MARK 2 MARK 3 SEM. MK	

	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	

TAPE LABLE "GRADE 200" INPUT GR-220 OUTPUT GR-200	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	SCHOOL NO. COUNTY	DISTRICT	SCHOOL	STUDENT NUMBER	STUDENT NAME	GRADE LEVEL	COUNSELOR	ROOM NUMBER	COURSE SEC. #	MARK 1 MARK 2 MARK 3 SEM. MK	

	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	

	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	

	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	

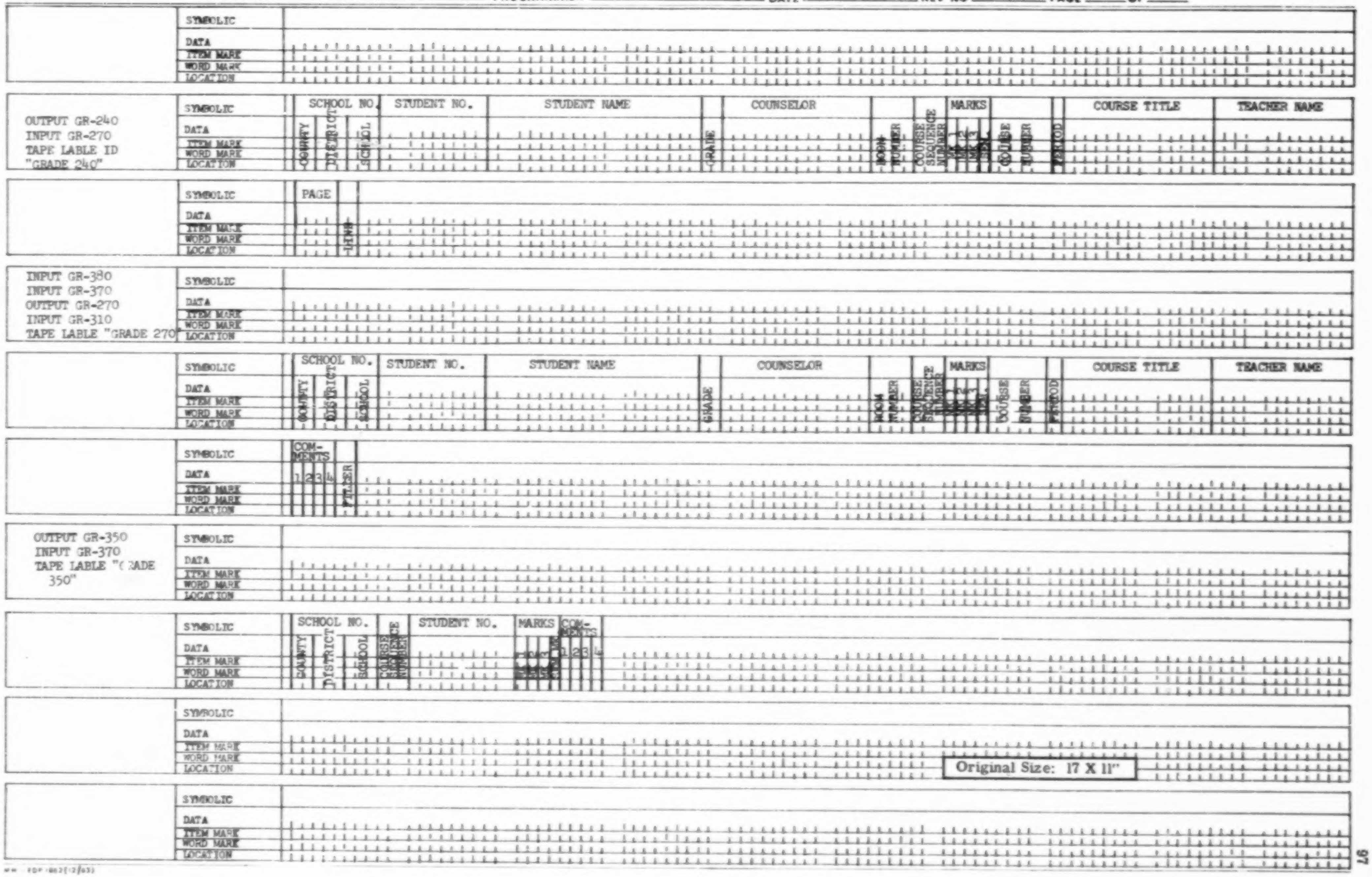
Original Size: 17 X 11"

DETAIL
MEMORY LAYOUT

Grade Reporting Tape

Honeywell
ELECTRONIC DATA PROCESSING

PROGRAM ______ PROGRAMMER ______ DATE ______ REV NO ______ PAGE ____ OF ____



	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	
OUTPUT GR-240 INPUT GR-270 TAPE LABLE ID "GRADE 240"	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	SCHOOL NO. (COUNTY, DISTRICT, SCHOOL) · STUDENT NO. · STUDENT NAME · GRADE · COUNSELOR · ROOM NUMBER · COURSE SEQUENCE NUMBER · MARKS · COURSE NUMBER · PERIOD · COURSE TITLE · TEACHER NAME
	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	PAGE · LINE
INPUT GR-380 INPUT GR-370 OUTPUT GR-270 INPUT GR-310 TAPE LABLE "GRADE 270"	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	
	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	SCHOOL NO. (COUNTY, DISTRICT, SCHOOL) · STUDENT NO. · STUDENT NAME · GRADE · COUNSELOR · ROOM NUMBER · COURSE SEQUENCE NUMBER · MARKS · COURSE NUMBER · PERIOD · COURSE TITLE · TEACHER NAME
	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	COM-MENTS 1 2 3 4 · FILLER
OUTPUT GR-350 INPUT GR-370 TAPE LABLE "GRADE 350"	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	
	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	SCHOOL NO. (COUNTY, DISTRICT, SCHOOL) · COURSE SEQUENCE NUMBER · STUDENT NO. · MARKS · COM-MENTS 1 2 3 4
	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	
	SYMBOLIC DATA ITEM MARK WORD MARK LOCATION	

Original Size: 17 X 11"

DETAIL
MEMORY LAYOUT

Decoded Mark Reporting Tape

Honeywell
ELECTRONIC DATA PROCESSING

PROGRAM ______ PROGRAMMER ______ DATE ______ REV NO ______ PAGE ____ OF ____

OUTPUT GR-250 INPUT GR-270	SYMBOLIC	SCHOOL NO.			PAGE	STUD.#1			#2		#3		#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15	#16	#17
	DATA	COUNTY	DISTRICT	SCHOOL		CODE	MARK	COMMENTS	MARK	COMMENTS	MARK	COMMENTS														
	ITEM MARK																									
	WORD MARK																									
	LOCATION																									

	SYMBOLIC	#18	#19	#20	#21	#22	#23	#24	#25	#26	#27	#28	#29	#30	#31	#32	#33	#34	#35	#35	
	DATA																				
	ITEM MARK																				
	WORD MARK																				
	LOCATION																				

	SYMBOLIC	
	DATA	
	ITEM MARK	
	WORD MARK	
	LOCATION	

	SYMBOLIC	
	DATA	
	ITEM MARK	
	WORD MARK	
	LOCATION	

TAPE LABLE "SUMMARY"

OUTPUT GR-270 SUMMARY TAPE INPUT GR-280	SYMBOLIC	SCHOOL NO.			TEACHER NAME	COURSE #		COURSE TITLE	#A	#B	#C	#D	#F or I	% A	% B	% C	% D	% F or I	GPA	
	DATA	COUNTY	DISTRICT	SCHOOL			PERIOD													
	ITEM MARK																			
	WORD MARK																			
	LOCATION																			

	SYMBOLIC	
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	ITEM MARK	
	WORD MARK	
	LOCATION	

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	ITEM MARK	
	WORD MARK	
	LOCATION	

	SYMBOLIC	
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	ITEM MARK	
	WORD MARK	
	LOCATION	

Original Size: 17 X 11"

	SYMBOLIC	
	DATA	
	ITEM MARK	
	WORD MARK	
	LOCATION	

DETAIL
MEMORY LAYOUT

F&I-GPA Tape

Honeywell
ELECTRONIC DATA PROCESSING

PROGRAM ______ PROGRAMMER ______ DATE ______ REV NO ______ PAGE ______ OF ______

Failure or Incomplete Record	SYMBOLIC		SCHOOL NO.				COUNSELOR		STUDENT NAME		COURSE TITLE					MARKS	
	DATA	RECORD 1	COUNTY	DISTRICT	SCHOOL					GRADE						[illegible]	
	ITEM MARK																
	WORD MARK																
	LOCATION																
OUTPUT GR-310 INPUT GR-330	SYMBOLIC																
	DATA																
	ITEM MARK																
	WORD MARK																
	LOCATION																
Student GPA Record by Grade Level	SYMBOLIC		SCHOOL NO.				SPACES		STUDENT NAME							SPACES	GPA
	DATA	RECORD 2	COUNTY	DISTRICT	SCHOOL	GRADE				GRADE	TOTAL A'S	TOTAL B'S	TOTAL C'S	TOTAL D'S	TOTAL F OR I		
	ITEM MARK																
	WORD MARK																
	LOCATION																
	SYMBOLIC																
	DATA																
	ITEM MARK																
	WORD MARK																
	LOCATION																
Student GPA Record Sorted by highest student to lowest.	SYMBOLIC		SCHOOL NO.			GPA	SPACES		STUDENT NAME							SPACES	GPA
	DATA	RECORD 3	COUNTY	DISTRICT	SCHOOL	reverse for sort				GRADE	TOTAL A'S	TOTAL B'S	TOTAL C'S	TOTAL D'S	TOTAL F OR I		
	ITEM MARK																
	WORD MARK																
	LOCATION																
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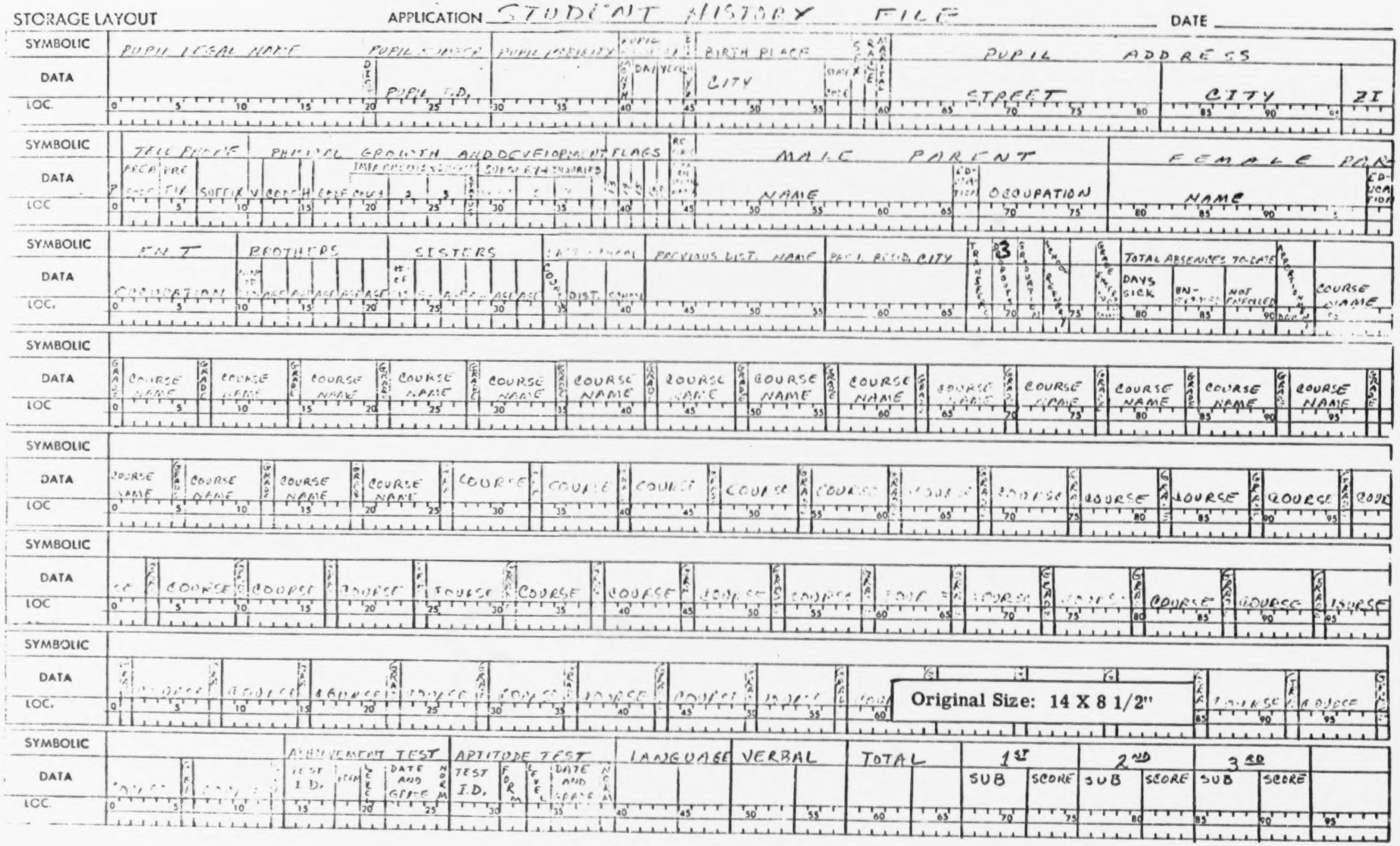
Original Size: 17 X 11"



STORAGE LAYOUT APPLICATION STUDENT HISTORY FILE DATE

SYMBOLIC: PUPIL LEGAL NAME | PUPIL NUMBER | PUPIL MOBILITY | PUPIL BIRTH DATE | BIRTH PLACE | SEX | RACE | MARITAL | PUPIL ADDRESS

DATA: DIST | PUPIL I.D. | MONTH | DAY | YEAR | CITY | STATE CODE | STREET | CITY | ZI

SYMBOLIC: TELE PHONE | PHYSICAL GROWTH AND DEVELOPMENT FLAGS | MALE PARENT | FEMALE PAR

DATA: P | AREA CODE | PRE FIX | SUFFIX | V | ORTH | H | CELF COUNT | INFECTIOUS SERIOUS 2 3 | SURGERY & INJURIES | NAME | EDUCATION | OCCUPATION | NAME | EDUCATION

SYMBOLIC: ENT | BROTHERS | SISTERS | LAST SCHOOL | PREVIOUS DIST. NAME | PREV. RESID. CITY | TRANSFER | 3 DROPOUT | GRADUATION | SCHOOL RETURN | GRADE ENTERED | TOTAL ABSENCES TO-DATE | PROMOTION

DATA: OCCUPATION | NUM OF | AGE | AGE | AGE | AGE | # OF | AGE | AGE | COUN | DIST. | SCHOOL | DAYS SICK | UN-EXCUSED | NOT ENROLLED | COURSE NAME

SYMBOLIC:

DATA: GRADE | COURSE NAME | GRADE | COURSE NAME | GRADE | COURSE NAME | GRADE | COURSE NAME | GRADE | COURSE NAME | GRADE | COURSE NAME | GRADE | COURSE NAME | GRADE | COURSE NAME | GRADE | COURSE NAME | GRADE | COURSE NAME | GRADE | COURSE NAME | GRADE | COURSE NAME | GRADE | COURSE NAME | GRADE | COURSE NAME | GRADE

SYMBOLIC:

DATA: COURSE NAME | GRADE | COURSE NAME | GRADE | COURSE NAME | GRADE | COURSE NAME | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COUR

SYMBOLIC:

DATA: GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE

SYMBOLIC:

DATA: GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE | COURSE | GRADE

Original Size: 14 X 8 1/2"

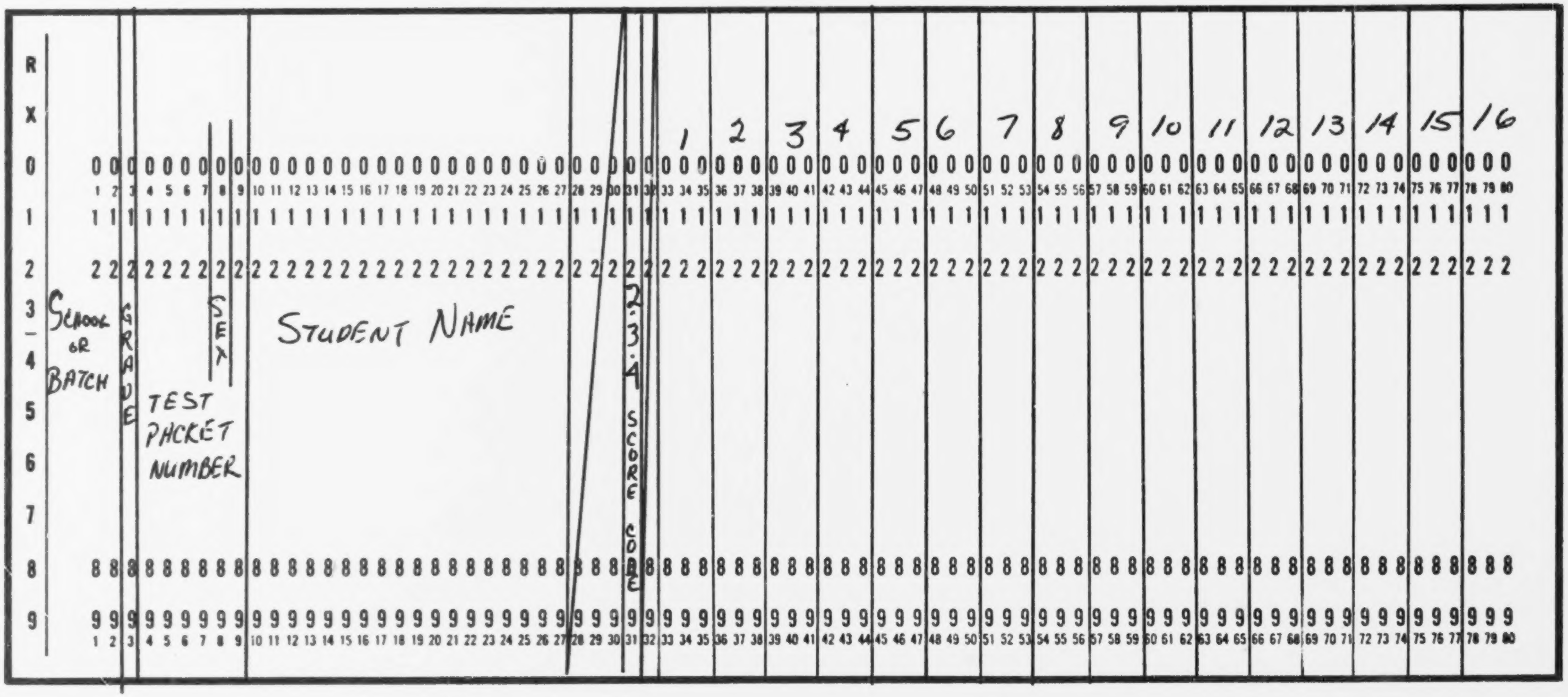
SYMBOLIC: ACHIEVEMENT TEST | APTITUDE TEST | LANGUAGE | VERBAL | TOTAL | 1ST | 2ND | 3RD

DATA: COURSE | GRADE | COURSE | TEST I.D. | ITEM | LEVEL | DATE AND GRADE | NORM | TEST I.D. | FORM | LEVEL | DATE AND GRADE | NORM | SUB | SCORE | SUB | SCORE | SUB | SCORE

LOC. 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95

Honeywell
ELECTRONIC DATA PROCESSING

Layout Form - 80 Column Card


R
X
0
1
2
3
–
4
5
6
7
8
9
SCHOOL OR BATCH
GRADE
TEST PACKET NUMBER
SEX
STUDENT NAME
2
3
4
SCORE CODE
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

Title Test Score

Prepared By ______ For Program ______

By Programmer ______ Checked By ______

Date ______ Remarks ______ Same Size

Modification ______ Page ______ Of ______

MH — EDP 1034 (1/64)

Project Paper

7040 SCHEDULING SYSTEM

The 7040 SKEDJUL is based on the 7090 system of assigning pupils to classes. The 7090 system was written by G. E. Anderson of Harvard University for NEEDS. The basic differences of the 7040 system from the 7090 are the calling sequences, compliment indexing in the MAP subroutines, inclusion of logical statements, and other Fortran IV features.

Version I of the 7040 Scheduling System operates identically to the 7090 system. It uses the same card layouts, and the output is the same. Exclusion of the "house" assignment feature is the only difference from the 7090 system.

Version II of the 7040 Scheduling System has been modified to accept course reference numbers of four digits, which may be increased easily to six. The course reference number may be either numeric or alpha numeric. Version II contains a provision for summarizing the master class list information. Previously the master schedule was listed before and after each run, but now it is listed only after each run. This list includes the number of seats taken, number of seats filled, and the percent of the available seats used. Other subroutines, TIME and PERCON, have been added, and time periods may be optionally converted in the final output to the traditional period and day-of-the-week representation. The course conflict matrix now has course title as well as section and course number to aid in identifying conflicts. "Good" schedules are now printed out in period order, with the exception that an unscheduled period does not sort in order but prints last.

The 7040 Skedjul program, consisting of one main and 16 subroutines, is used for the assignment of pupils to a predetermined master schedule. The many available options are controlled by a parameter card.

This program can handle two semesters at once, seven or fewer periods per school day, and up to 1,200 sections divided in any manner among a maximum of 350 courses. Since students are processed sequentially, any number of students can be handled within the permissible number of sections.

Most uses of this program are of two types:

1. Simulation runs. Output is limited to details of students who cannot be scheduled and section balances.

2. Production runs. Output is provided for printing student schedules and section (class) lists.

Operating instructions for the program are as follows:

1. Keypunch parameter card, starting in column 1:

   a. Simulation run: normally,______________________
   b. Production run: normally,______________________

   See options available for other possibilities.

2. Organize computer run.

   1. $JOB
   2. $IBJOB
   3. $IBREL
   4. Computer program
   5. $Entry APTC
   6. (Parameter card)
   7. Master schedule
   8. Blank card
   9. Student course request card file
   10. Blank card
   11. $IBSYS

CROSS TALLY

Program CROSS is a combination of simple tally and cross tally. This program can handle up to 250 sections per school and 999 schools per run. CROSS operates through the use of the following control cards:

1. Jobs card--has number of schools to be processed punched in columns 1-4 (one per run)

2. School title card--36 digits of title information (must precede each school)

3. Blank No. 1--must follow course catalog (must be present)

4. Blank No. 2--is inserted in the middle of the student deck, causing file to write half on each of two tapes, to speed up operation (must be present)

5. Blank No. 3--at end of student file (must be present)

If more than one school is run, the school title card of the next school follows the third blank card of preceding school.

COURSE CARDS

The cards used with the cross tally are described in the sections that follow.

A card for each subject taught is used with cross tally to indicate valid course numbers. This card provides for the collection of data as follows:

Columns 2-5	Course number
Columns 44-59	Course title

Course Request Card. One Course Request Card is used for each student. This card provides for the collection of data as follows:

Columns 1-40	Student's I.D.
Columns 41-80	Up to 9 four-digit course numbers

Course Section Card. One Course Section Card is used for each section. This card provides for the recording of data as follows:

Column	Right or left justification	Data	Instructions
1		None	
2 - 5	Right	Course number	Alpha or numeric
6 - 11	Left	Time periods	
12 - 14		None	
15		Semester	Numeric only
16 - 18	Right	Minimum class size desired	Numeric only
19 - 21	Right	Maximum class size desired	Numeric only
22 - 32	Left	Teacher name	
33 - 35		None	
36 - 37	Right	Teacher number	
38 - 40		None	

Column	Right or left justification	Data	Instructions
41 - 43		Room number	
44 - 59		Course title	

The numbers 9991 through 9997 have special meaning and shall not be used by the school.

Student Course Request Card. One Student Course Request Card is issued to each student. This card provides for data as follows:

Column	Data	Instructions
1 - 40	Student I.D.	Data in any format. Same format will be reproduced in all output.
41 - 80	Up to nine courses with four-digit numbers followed by four blanks.	The last digit indicates the period which is not to be scheduled, and is interpreted by the program to be the alpha period corresponding to the digit. At the present time only one semester may be blocked. Blocking of periods is achieved through the use of the reserved numbers 9991 through 9997.

CONTROL CARDS

Control Card 1 provides for the following:

	Cols.	1-4	0	Inoperative switches
K1	Col.	5	N	Logical device for output good schedules 6=Print/1-5=Tape
K2	Col.	6	0	
K3	Col.	7		(0 = Print only) (△ = Write/Print) (1 = Write (in) only)
IPM	Col.	8	0	Inoperative switch

IPS	Col. 9	0	Inoperative switch
ISP	Col. 10	1 0	Print good schedules Do not print good schedules
IAS	Col. 11	0	Inoperative switch
OPREQ	Col. 12	1 0	Print message identifying request error Do not print message identifying request error
IMS	Col. 13	0	Inoperative switch
OPDEL	Col. 14	1 0	Partially schedule with conflict deleted from schedule Do not partially schedule
IPRTBL	Col. 15	1 0	Do not print trials table Print trials table
IPR	Col. 16	1	
ISTUD	Col. 17	1 0	Do not print unassigned period msg Print unassigned period
ICONF	Col. 18	1 0	Print conflict matrix for each student with conflicts Do not print conflict matrix
TITLE			
SCH			

Control Card 2 provides for the following:

	Data
Cols. 7 - 14	County - School - District Code
Cols. 15 - 44	School name

Coding Time Patterns for the Computer

Present computer scheduling programs accept time patterns for section (class) meetings described in a letter-number coordinate system. Two such systems follow:

Traditional Schedule					
Time	Mon.	Tue.	Wed.	Thu.	Fri.
8- 9	A1	A2	A3	A4	A5
9-10	B1	B2	B3	B4	B5
10-11	C1	C2	C3	C4	C5
11-12	D1	D2	D3	D4	D5
12- 1	E1	E2	E3	E4	E5
1- 2	F1	F2	F3	F4	F5
2- 3	G1	G2	G3	G4	G5

Rotating Schedule					
Time	Mon.	Tue.	Wed.	Thu.	Fri.
8- 9	A1		A2	A3	A4
9-10	B1	B2	B3		B4
10-11	C1	G1	F2	E3	D4
11-12	D1	C2	G2	F3	E4
12- 1	E1	D2	C3	G3	F4
1- 2	F1	E2	D3	C4	G4

In addition, the letter P is recognized in both systems, usually standing for afterschool time used for extracurricular activities such as football, journalism, and the like. Similar letter-number coordinate systems can be devised for most high school schedule time patterns. The rules are:

1. Only the letters A through G may be used as part of the coordinate system, although the letter P is available for special purposes.

2. A particular letter should be used to designate a time pattern common to many classes. Thus, in the rotating schedule above, the letter C represents the meeting times of a class in a semi-rotating schedule. C is a much simpler representation than the C1D2E3F4, which would be required in the traditional schedule.

3. The numbers 1 through 5 are available to indicate a particular part of a time pattern. In the traditional schedule above, A135 indicates 8 a.m. on Monday, Wednesday, and Friday.

4. A letter by itself indicates every meeting time of a particular time pattern.

5. Sections with extra meeting times, such as laboratory courses, may be described by using two letters. CD3 indicates all of time pattern C and the third meeting time of pattern D.

6. Letters always precede any numbers that are used to indicate particular parts of time patterns. C3D means all of D and the third time C meets, but 3C is meaningless.

Coding Master Schedule Information for the Computer

Course number. Use the number assigned to the course concerned. Each course in the course catalog should have at least one section described.

Meeting time. Up to six letters and numbers may be used to describe when the section meets.

Semester. The semester in which a section meets.
1 = First semester only
2 = Second semester only
3 = Full year

Seats. MIN is the desired number of pupils in this section. The sum of the MIN seats for all sections of a course should equal at least the number of pupils requesting the course. MAX is the maximum number of pupils that may be allowed in this section. For multiple section courses, MAX seats should be somewhat greater than MIN seats for each section. A "last resort" section (such as NOT SCHEDULED or tenth grade gym section for a student in grade eleven) may have MIN seats 0 and MAX seats some small number. The number of seats available may be adjusted during the scheduling process to help balance sections.

Teacher number. Use the number assigned to the teacher of the section being described.

Room. Either a number or letters may be used to describe the meeting place.

"NOT SCHEDULED" sections should have no teacher number or room assigned.

Preparing the School Master Schedule File for Computer Runs

Since the efficiency of the Assignment of Students to Classes algorithm depends on trying to schedule the courses with fewest sections and most irregular time patterns first, the school master schedule file should be sorted into an appropriate order. This should be done as follows:

1. Start with the school master schedule file in order by period within course.
2. Hand sort into piles of courses which have just one meeting time, two meeting times, three meeting times, etc. All cards for a course must be kept together. Note that it is the number of meeting times rather than the number of sections that is important; a course having two sections meeting at the same time receives the same treatment as a course with one section. In general, the following variations may also be desirable:
    a. Courses with irregular time patterns may be classified as if there were one less meeting time. Thus, a four section course (all sections meeting at different times) involving a lab might come with the three section (or, more precisely, three meeting time) courses.

b. Classification may be according to the number of meeting times available in the MIN seats category. Extra sections available only under the MAX seats category need not count.

c. Some slight improvement in badly balanced courses may occur if the cards for such courses come earlier in the school master schedule file given the computer. Thus, a badly balanced four-section course may come out better when put with the three-section courses. However, this strategy may drive poor section balances elsewhere in the master schedule.

The reordered master schedule file must still have all the cards of a given course together. The file should be ended with one blank card. Except for these two restrictions, there is considerable latitude in how cards are ordered. The worst that can happen with a poor ordering of the master schedule file is a tenfold increase in computer time.

SAMPLE OUTPUT DESCRIPTIONS

1.
```
ERRORS = 0, COURSES = 265, CLASSES = 398, LAST = 1052
```

"ERRORS = 0" reflects only whether or not the last student was satisfactorily scheduled. "LAST = 1052" shows that 1052 students have been processed in this run. If the final printout read "LAST = 0," it would indicate that no students had been processed at the time the description was printed.

2.
```
TOO MANY TRIALS
7373E8  ANSHEN  ALAN 0000  TRYS=999  STOPPED AT LEVEL 8  SEQ=484
COURSE     A   B   C   D   E   F   G   N
1747       0   0   1   1   1   1   1  11   GOVT     4  B    50
0511       0   0   1   1   1   0   0   3   PUB SPK          20
5711       0   0   1   0   1   0   0   4   SCULPT          127
5310       0   1   0   0   0   0   1   2   CERAMIC1        119
9040       1   1   1   1   1   1   0  12   BOYS PE4        182
7650       0   1   1   1   0   1   1   5   GR ARTS1        156
9910       1   0   0   0   0   0   0   2   HOME 1          216
9600       0   1   1   1   1   1   1   6   ART LABS
Course 9600 DELETED
```

The preceding description indicates that a student could not be scheduled because of too many trials. Such a printout could also be preceded by "COMBINATIONS EXHAUSTED," if that was the reason why the computer could not schedule the student.

In this instance, student number 7373E84, Alan Anshen, had no time (0000) blocked out on his course request card. However in 999 attempts (TRYS) to schedule this student, stopping at level 8, the computer discovered that this student, the 484th whom the computer tried to schedule, had an irresolvable conflict between course 9600 and all others. Columns A-G, which show class periods, list the times a section meets; 3 indicates that a section meets all year, and 1 or 2 indicates the first or second semester only. The N column lists the number of classes or sections available for each course.

3.
```
REQUEST ERROR       7373E99 ANWAY   DAVID       INVALID NO. 246
```

This is printed if parameter card column 12-1 and a course request number do not appear in the master schedule. This request is deleted, and processing continues normally.

4.
```
ASS 9660 MINIMUM SEATS FULL WOOD LBAS F 589 STUDENTS PROCESSED, 15
```

These messages are printed as the last minimum (FULL) and last maximum (CLOSED) seats are taken. The last number (975) indicates how many students have been processed when this occurs.

```
5.          7373E84 ANSHEN           ALAN      0000          14
     9910    HOME 1                            A    623
     7650    GR ARTS1       K12    BURNES      B    360
     1747    GOVT    4   B  B 6    NICHOLS     C    143
     0511    PUB SPK        U 4    ERICKSON    D     44
     5711    SCULPT         K 5    ADAMS       E    308
     9040    BOYS PE4       G11    PETERS R    F    439
     5310    CERAMIC1       K 5    ADAMS       G    295

            7373E99 ANWAY            DAVID     0000          15
     9910    HOME 1                            A    624
     6010    BKKEEP 1       U 5    GRIMM       B    309
     7620    DRAFT 2        K16    BURNES      C    359
     9040    BOYS PE4       G11    HARKNESS    D    437
     1416    GOVT    1   C  N 3    WARFORD     E    126
     9660    WOOD LABS      L 1    MERKLEY     F    589
              UNASSIGNED PERIOD                7
```

This is the information printed to show how a satisfactory schedule has been worked out for the students in samples 3 and 4. Column 3 is room numbers; 4, teacher names; 5, course periods; 6, class section numbers. Numbers 14 and 15 identify student sequence

Additional printed information at the end of the run includes the number of students scheduled in each of several modes and a trials table that gives the number of students whose schedules took any given number of trials up to 250. The more students taking over two or three trials, the more students assigned in the MAXS or Alternated modes, the harder the master schedule is to execute.

MASTER SCHEDULE LIST (CLASS OR SECTION DIRECTORY)

[illegible]	SECT.	TIME	MOD.	SEM.	COURSE TITLE	TEACHER	ROOM	TIME	MIN	MAX	USED	REM.	P
[illegible]	1	F		1	PHYS LBAS	BUTTERFIEL	E 5	6	1	2	0	2	
0234	2	F		1	ENGLISH3 B	JOHNSON S	D 4	6	900	900	0	900	
[illegible]	3	O		0	ENGLISH3 A	JOHNSON S	A 3	0	20	28	0	28	
[illegible]	4	D		1	ENGLISH3 A	JADWIN	D 4	4	20	28	0	28	
[illegible]	5	E		1	ENGLISH3 A	JOHNSON S	A 3	5	20	28	0	28	
[illegible]	6	F		1	ENGLISH3 A	JOHNSON D	A 3	6	20	28	0	28	
[illegible]	7	F		1	ENGLISH3 AP	JADWIN	B 2	6	900	900	0	900	
0243	8	C		1	ENGLISH4 B	PUTNAM	A 8	3	900	900	0	900	
0245	9	D		1	ENGLISH4 S	KICKBUSCH	A 2	4	900	900	0	900	
0246	10	B		1	ENGLISH4 C	CUSHING	B 3	2	14	25	1	24	
0246	11	D		1	ENGLISH4 C	HOYT	B 3	4	13	25	2	23	
0247	12	B		1	ENGLISH4 B	BRADSHAW	D 2	2	18	30	2	28	
0247	13	B		1	ENGLISH4 B	ERICKSON	D 4	2	18	30	2	28	
0247	14	B		1	ENGLISH4 B	LEON	A 4	2	17	30	3	27	
0247	15	C		1	ENGLISH4 B	CUSHING	B 3	3	18	30	2	28	
0247	16	C		1	ENGLISH4 B	LESLIE	A 7	3	18	30	2	28	
0247	17	D		1	ENGLISH4 B	CUSHING	A 3	4	17	30	3	27	
0247	18	E		1	ENGLISH4 B	HOYT	A 7	5	17	30	3	27	
0247	19	F		1	ENGLISH4 B	BRADSHAW	D 2	6	18	30	2	28	
0247	20	G		1	ENGLISH4 B	BRADSHAW	D 2	7	17	30	3	27	
0247	21	G		1	ENGLISH4 B	LEON	A 4	7	17	30	3	27	
0248	22	B		1	ENGLISH4 A	LESLIE	A 7	2	17	30	3	27	
0248	23	D		1	ENGLISH4 A	LESLIE	A 7	4	18	30	2	28	
0248	24	E		1	ENGLISH4 A	LEON	A 4	5	18	30	2	28	
0248	25	F		1	ENGLISH4 A	TANNER	B 3	6	17	30	3	27	
0248	26	G		1	ENGLISH4 A	CUSHING	B 3	7	17	30	3	27	
0248	27	G		1	ENGLISH4 A	HOYT	A 7	7	17	30	3	27	
0249	28	E		1	COL ENG AP	TANNER	B 3	5	899	900	1	899	
[illegible]	29	B		1	ENGLISH3 C	ROWLAND	B 4	2	1	4	0	4	
[illegible]	30	C		1	ENGLISH3 C	ROWLAND	B 4	3	1	4	0	4	
[illegible]	31	C		1	ENGLISH3 B	ERICKSON	D 4	3	1	2	0	2	
[illegible]	32	D		1	ENGLISH3 B	JOHNSON D	B 7	4	1	2	0	2	
0257	33	E		1	ENGLISH3 B	JOHNSON D	B 7	5	1	2	0	2	
0257	34	G		1	ENGLISH3 B	JOHNSON D	A 3	7	1	2	0	2	
0320	35	F		1	JOURNAL2	BYAN	B 4	6	900	900	0	900	
0330	36	F		1	JOURNAL3	BYAN	B 4	6	900	900	0	900	
0340	37	F		1	JOURNAL4	BYAN	B 4	6	899	900	1	899	
0411	38	B		1	DEVREAD11	MEYER	A 6	2	900	900	0	900	
0412	39	B		1	DEVREAD12	MEYER	A 6	2	900	900	0	900	
[illegible]	40	E		1	READ LB1	KOCHER	A 6	5	900	900	0	900	
0451	41	E		1	READ LB11	KOCHER	A 6	5	900	900	0	900	
[illegible]	42	E		1	READ LB11	KOCHER	A 6	5	900	900	0	900	
0511	43	C		1	PUB SPK	BUCK	C 2	3	13	25	2	23	
0513	44	D		1	PUB SPK	ERICKSON	U 4	4	13	25	2	23	
0511	45	E		1	PUB SPK	BUCK	C 2	5	11	25	4	21	
0610	46	G		1	YRBOOK 1	MEYER	A 6	7	900	900	0	900	
0620	47	G		1	YRBOOK 2	MEYER	A 6	7	899	900	1	899	
0710	48	B		1	CR WRIT1	HOYT	A 3	2	899	900	1	899	
1207	49	B		1	CONTWLD11 B	CHANTELOUP	J12	2	1	3	0	3	
1207	50	C		1	CONTWLD11 B	CHANTELOUP	J12	3	1	3	0	3	
1207	51	D		1	CONTWLD11 B	CHANTELOUP	J12	4	1	3	0	3	
1207	52	E		1	CONTWLD11 B	KELLY	J12	5	1	3	0	3	
1216	53	F		1	CONTWLD1 C	KELLY	J12	6	3	6	0	6	
1216	54	B		1	CONTWLD1 C	CHANTELOUP	J12	2	3	6	0	6	
[illegible]	55	B		1	CONTWLD1 C	KELLY	J11	2	3	6	0	6	
1216	56	C		1	CONTWLD1 C	WARFORD	D 5	3	3	6	0	6	
1216	57	C		1	CONTWLD1 C	RINGUETTE	J10	3	3	6	0	6	
1216	58	C		1	CONTWLD1 C	MEDLEN	B 7	3	3	6	0	6	
1216	59	D		1	CONTWLD1 C	WARFORD	D 5	4	3	6	0	6	
1216	60	D		1	CONTWLD1 C	MEDLEN	J11	4	3	6	0	6	

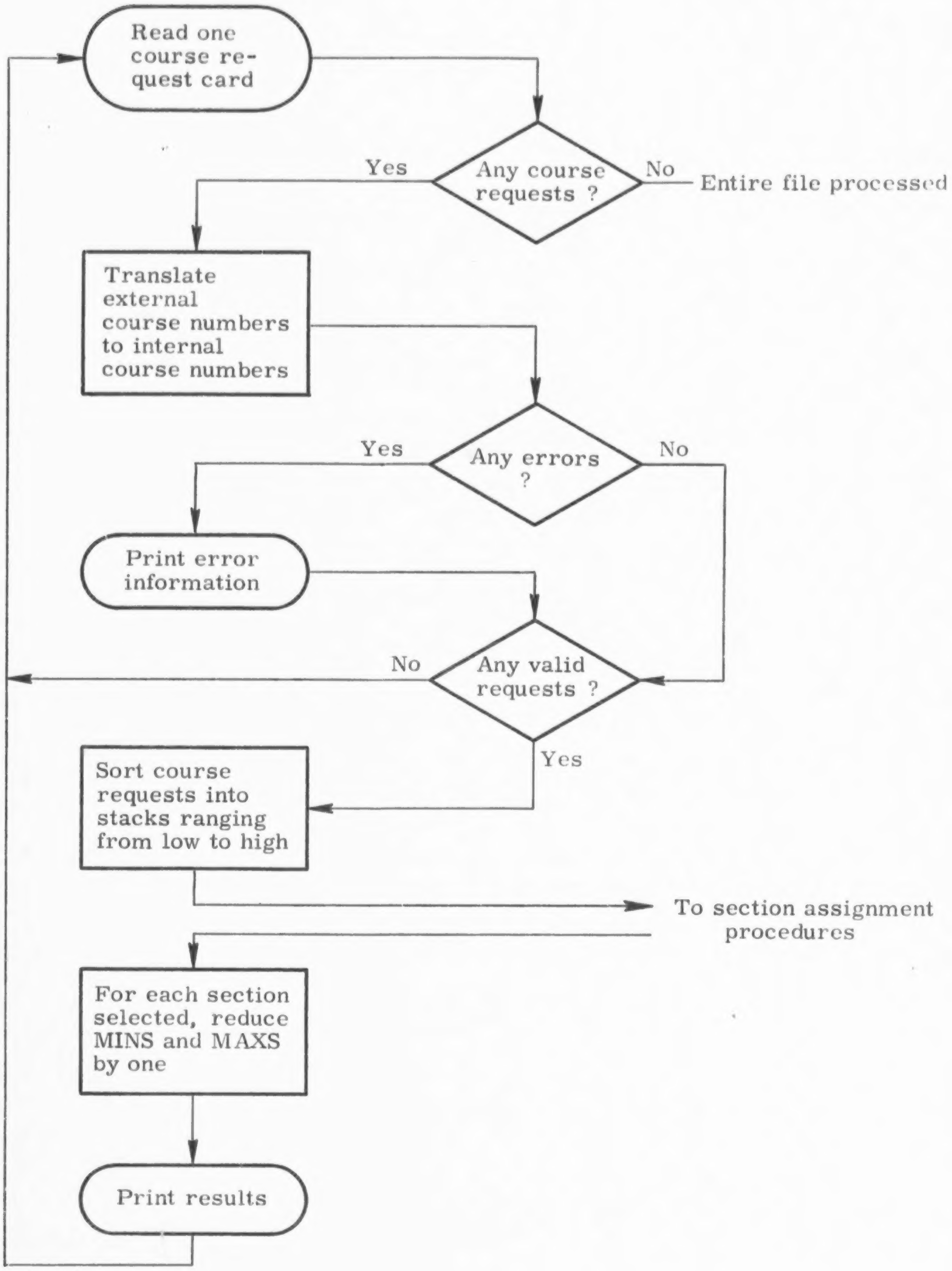
LIST OF PROGRAMS IN THE 7040 SCHEDULING SYSTEM

APTC (Fortran)	Main routine. Prints schedules. Keeps section tally.
CLIST (Fortran)	Course list input routine. Reads course list and converts time period to binary vector. Assigns index number and stores all course information in arrays IXCNR, ICNR DETAIL (1-6), TCHR (1-3), MINS, MAXS, ISEM
PREAD (Fortran)	Student course request input routine. Reads student course request cards and converts course numbers to internal index numbers.
SKED (MAP)	Does actual scheduling. Builds matrix of applicable courses and finds period availability by examining the time vector. Adds all assigned period vectors logically and tests unassigned vectors against the sum to determine conflict. If conflict is in first column of matrix, exchanges pairs of courses and tries again.
SORT RN (MAP)	Internal sorting routine. Sort may be either ascending or descending.
CLPR (Fortran)	Prints final master schedule.
CVPER (MAP)	Converts alphanumeric period to binary vector.
PERCV (MAP)	Converts binary vector to alphanumeric period.
CONFP (Fortran)	Prints conflict matrix.
STUDY (Fortran)	Prints study hall information.
CVTV	Converts binary vector for printing in conflict matrix.
STPER	Assigns study halls.

SUMMARY TABLE OF VARIABLES

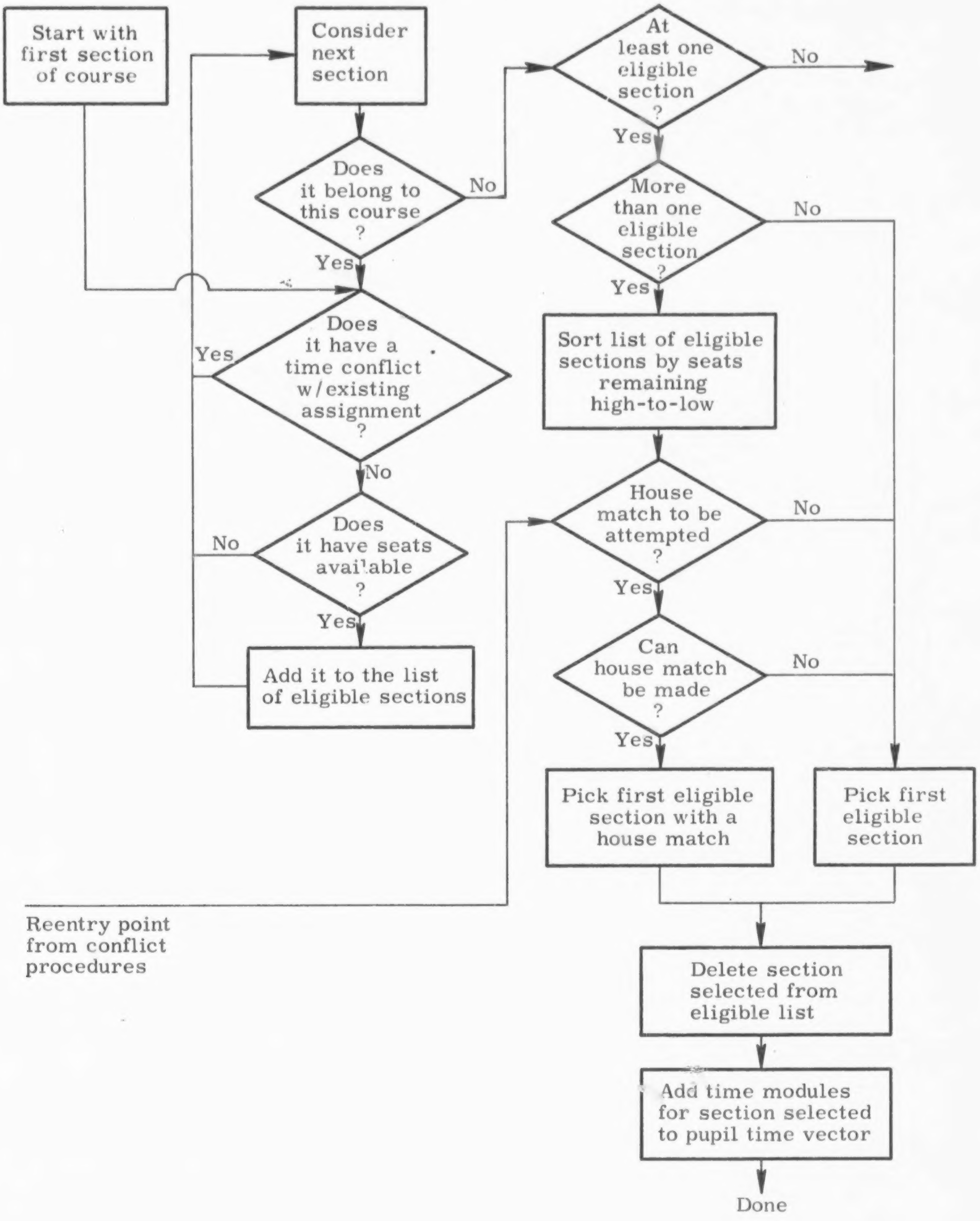
	SKED Subroutine
External four digit number table	IXCNR
Index to external course numbers, three digits	(JEXT)
Set of internal course numbers	(JINT)
Section numbers	
Vector of student section assignments	IX (11-20)
Student identification information	IX (21-27)
Matrix of section descriptions	DETAIL
Mode of search indicator	IMS
Trial counter	IERC
First section numbers	IFCL
Last section numbers	ILCL
Vector of student course requests	IX (1-10)
Student time vector	STV
Section time vector	CTV
Workspace matrix	IWA
Minimum seats per section	MINS
Maximum seats per section	MAXS
Maximum allowable trials	MAXE

Reorganizing Student Course Requests for Section Assignment

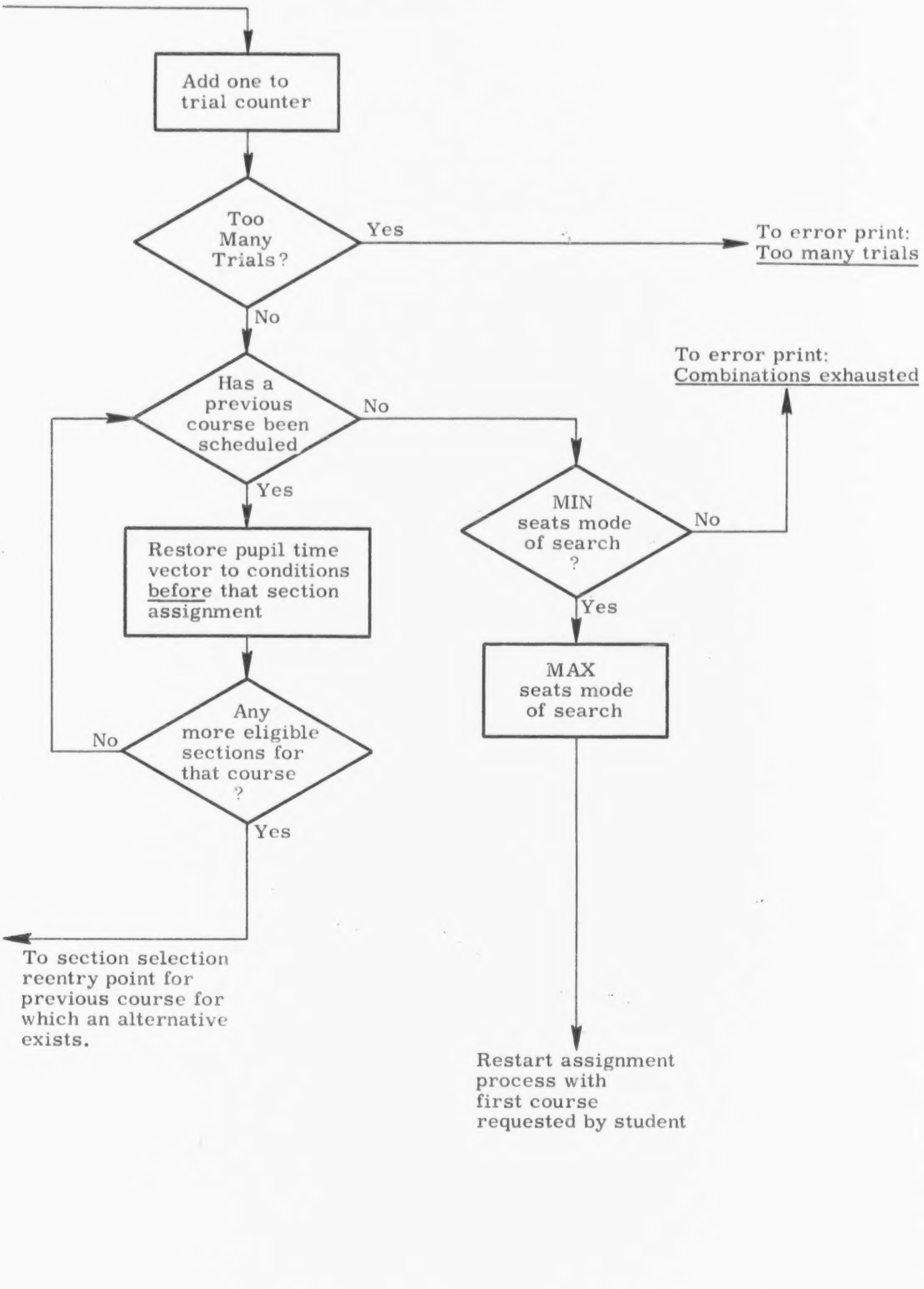

Read one course request card
Any course requests ?
Yes
No
Entire file processed
Translate external course numbers to internal course numbers
Any errors ?
Yes
No
Print error information
Any valid requests ?
No
Yes
Sort course requests into stacks ranging from low to high
To section assignment procedures
For each section selected, reduce MINS and MAXS by one
Print results

← 8½ →

Decision Process for Selecting a Section for a Requested Course


Start with first section of course
Consider next section
Does it belong to this course ?
No
Yes
Does it have a time conflict w/existing assignment ?
Yes
No
Does it have seats available ?
No
Yes
Add it to the list of eligible sections
At least one eligible section ?
No
Yes
More than one eligible section ?
No
Yes
Sort list of eligible sections by seats remaining high-to-low
House match to be attempted ?
No
Yes
Can house match be made ?
No
Yes
Pick first eligible section with a house match
Pick first eligible section
Reentry point from conflict procedures
Delete section selected from eligible list
Add time modules for section selected to pupil time vector
Done

Decision Process for Resolving Course Conflicts


Add one to trial counter
Too Many Trials?
Yes
To error print: Too many trials
No
Has a previous course been scheduled
No
To error print: Combinations exhausted
Yes
Restore pupil time vector to conditions before that section assignment
MIN seats mode of search ?
No
Yes
MAX seats mode of search
No
Any more eligible sections for that course ?
Yes
To section selection reentry point for previous course for which an alternative exists.
Restart assignment process with first course requested by student

Project Paper

COMPUTERS FOR COUNSELING AND GUIDANCE

BY ALVIN GROSSMAN
Director, Research and Development Center
in Educational Data Processing

Guidance without data is quackery. Yet all too often in the schools of today, momentous educational decisions concerning the lives and future careers of students are made with a dearth of information. Even when information is on hand, one is apt to find that little or no effort has been made to integrate it.

EDUCATIONAL INTELLIGENCE

In order to have a dynamic, functional guidance program, student information needs to be transformed into "educational intelligence." Comprehensive, accurate, timely data are vital, of course, to the success of any guidance program. These are the tools for objective decision-making. In the vast majority of school districts, such tools are either too old to be useful or inadequate in other ways. It is equally important that good tools be put into the hands of the counselors and the students at the time they are needed--when judgments are to be weighed and decisions are to be made. But the mere possession of information is not sufficient for effective decision-making. In order to reach valid decisions, guidance personnel must analyze and interpret those data that have significance.

THE PROMISE OF MODERN TECHNOLOGY

The link between school information and decisions has become a topic of considerable research. Rapidly increasing knowledge in such fields as social science, mathematics, and statistics is being brought to bear on the formulation and solution of these problems.

New means of collecting, processing, and applying information exists. It is becoming evident that these new techniques can contribute to more effective guidance procedures.

When we consider the recency of these developments, their acceptance to date is indeed remarkable. Although school acceptance has just begun, administrators, especially those in large school districts, are becoming increasingly aware of the potential which modern technology holds for their schools. The exploration of new methods for guidance services will be undertaken rapidly. Bold, long-range programs of wide scope will be required to realize the benefits of technological advances.

CONVERTING INFORMATION INTO ACTION

Technology can assist in preparing action-oriented reports, but it cannot make decisions. Good guidance practice is a process of converting information into action. The conversion process can be called decision-making; and, in turn, decision-making is controlled by various explicit and implicit policies of behavior.

If good counseling is a process of converting information into action, it should be clear that counseling success depends primarily upon what information is chosen and how it is converted. Often the difference between a good counselor and a poor counselor can be identified at this point. Although each counselor has available a large number of information sources, he selects and uses only a small fraction of the available information. Even then, he is likely to make incomplete and erratic use of it. In today's schools, the counselor determines which information sources he should use and which he should ignore. After he chooses a certain type of information or a certain class of information and decides which sources are best, his counseling success depends on what use he makes of the information. How quickly or how slowly does he convert this information into action? How does he create objectives from the information available? What is the relative weight he gives to different information sources in light of the desired objectives?

THE NEED FOR AUTOMATION IN A GUIDANCE PROGRAM

Certain basic elements are present in any effective guidance program. Two sets of variables stand out as essential to each activity aimed at providing good guidance services for the student: (1) data concerning the individual--his abilities, interests, aptitudes, experiences, and background; and (2) information about the area wherein he must make choices and plans. There is a direct and significant relationship between the effectiveness of guidance services and the direction high school graduates take in pursuit of occupational goals. Moreover, the need for sound guidance is heightened by the current national shortage in skilled manpower.

One of the greatest obstacles in the improvement of guidance practices is the vast amount of paperwork necessary for carrying out any large-scale guidance program. Pertinent data on identification and registration, attendance, scholastic progress, health status, home backgrounds, social adjustments, interests and plans, attitudes, special activities, and other factors in the school life of each student have to be gathered, assembled, and made readily available. All this effort involves a greater amount of clerical manipulation than is often imagined. Consequently, in many instances, the vital data do not reach the counselor or the classroom teacher in time to be of any real help.

What is needed in the average school district is a system which makes pupil personnel information easily available and furnishes reports when they are news, not history. The initial handling of student information should include both the collection of data and the subsequent entry into some type of student record. Much personnel data collection involves the gathering of information that is required for basic documents, and those documents are extremely diversified among various schools. Examples of such documents are test-reporting forms, grade reports, various honor and failure lists, attendance accounting forms, registration forms, and others too numerous to mention. Quite frequently information from these documents is collected from so many sources that one phase of the initial handling function is to relate the accumulated data. In districts providing computer-based services, the data can easily be processed and recorded, once they have been collected and related.

Putting the data to work in the form of educational intelligence is probably the most important part of the data-gathering, processing, and reporting cycle. At this point, perhaps, a differentiation should be made among "data," "information," and "educational intelligence" as these terms are used in data processing. "Data" are simply raw facts. "Information" is the manipulation of data in the form of a roster or a report. "Educational intelligence" is the combination of specific data with data that have been stored in files. Educational intelligence can be utilized to generate an action type of report that is meaningful to the person receiving it. Information is of no use if it cannot be used effectively by the counselor when he works with his counselees. The data must be meaningful and the counselor must be informed regarding their proper utilization. Data processing, too, must be geared (1) to the needs of the school; and (2) to the ability of the school staff to use the reports wisely and well. It is axiomatic that reports and statistics should not be issued just for the sake of reports and statistics.

The counselor is an information converter. He is the person to whom information flows and from whom meaningful decisions reached in concert with his counselees are issued--decisions that influence future actions of school youth.

With the advent of the computer, the solution to the urgent problems involving student data is not only possible but feasible. This new tool can be utilized effectively for the initial handling of information, for new methods of processing information, and finally for a new approach in making appropriate use of information in guidance programs.

STRUCTURING OF EDUCATIONAL INFORMATION SYSTEMS

Few, if any, efforts have been made to structure educational information systems. Many variations of such systems exist, but the systems are generally tailored to the needs of a particular school district in a particular period of time.

An educational information system may be considered to be an information retrieval system, and some portions of the system can be treated in this fashion. In general, however, information retrieval deals more with data than with information, attempting to seek historical facts rather than to monitor current trends. In this paper we will concentrate on developing an educational information system that can identify variances of performance from a "standard," or set of criteria, and allow this information to be relayed swiftly in understandable form to the appropriate school counselor. However, this information should be constructed in such a way that it means something. It is useless to report standard information which the counselor does not need.

Warning Techniques

Cooley relates that early automobiles had an oil pressure gauge, mounted on the dashboard, which would continuously record the oil pressure in the engine.[1] The little device was useless unless the driver knew the optimum pressure for maximum engine efficiency. Today, automotive engineers have convinced car manufacturers that it is more reasonable simply to have a red light indicate when the oil pressure is not what it should be, rather than to try to teach all American drivers the desired oil pressure for their particular engine. His analogy is clear. School reporting programs need to shift from a system of recording sets of numbers on student cumulative records to a procedure of "flashing red lights," which would indicate when certain students seem to be in particular kinds of danger.

Variance Factors

Varience from standard or criteria of performance must be decided by school personnel and especially guidance personnel. However, they must also take one more step and decide what is to be considered a significant variance. Clearly, if a student is in the tenth grade, fourth month, and his achievement test scores are in general at tenth grade, seventh month, guidance personnel would not usually be interested in this information. However, if his grade placement is tenth grade, fourth month, and he performs at the seventh-grade, second-month level, counseling personnel would be vitally interested in this alarming variance.

School counselors need to help administrators in their districts establish criteria against which student performance can be compared and, further, to help indicate a significance level to be applied to the variance. Data-processing systems can then be designed to compare the standards to actual performance and measure the variance significance during the normal updating pattern of data processing.

Uniform Use of Data

It is a recognizable fact that developing the information system and, within it, the task of organizing, maintaining, and using pupil personnel data has plagued the nation's schools almost without letup. Wide variations in school district policies and lack of uniformity both as to content of student information and as to appropriate methods of putting it to use have been thorns in the sides of educators and guidance personnel throughout the land.

Data kept by one district usually are not comparable to data kept by another. Transcript forms commonly are filed separately from cumulative record folders. Data gathering itself is often a haphazard operation; seldom, if ever, are attempts made to analyze or correlate the data so that they can be used profitably.

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[1] William W. Cooley, "A Computer-Measurement System for Guidance," Harvard Educational Review, Vol. XXXIV (Fall, 1964).

It has been emphasized in this paper that decisions must have their basis in information--but comprehensive, accurate, and timely data upon which decisions need to be based are vital to the success of any guidance program. That these tools are actually lacking in many places, at many times, and to a surprising extent was borne out by the work of Stewart and Workman[2] as well as the work of a California State Advisory Committee on Integrated Data Processing.[3]

CONCEPT OF THE REGIONAL PROCESSING CENTER

In order to achieve maximum potential from an educational intelligence system, one must look at the many alternative ways of obtaining services. After many years of experience, the author has found that generally the best way to achieve the maximum potential in the long run is to integrate all functions belonging to a group of school districts into one regional operating data center.

In California progress toward the goal of regional integration of all data processing facilities has been made by continual educational and economic pressures. School districts in many states are now moving toward a functional integration of an information system that combines information storage, information transfer, and information generation. This combination is created by all departments in a school district in such a way as to minimize (1) the number of points at which information enters and leaves the system; and (2) the total storage for all systems files. Once the information enters an integrated system, it is retained there so that reentry of the same data is never necessary.

Pressures for sharing data-processing systems will develop because the most economical way (and in some cases, the only way) for school districts of a certain size to justify data-processing equipment economically will be to share it with others. An intelligently planned regional data-processing system takes into account the needs of its cooperating school districts and allows each of them a say in the policy determination of such an operation.

Regional data-processing centers can be linked by high-speed communication devices to each school coming under their operational jurisdiction. In turn, each center can be linked to the other centers by additional communication devices.

The emerging pattern created by new communications developments will make on-line[4] systems for users spread over wide geographic areas more economical than batch processing[5] with centralized systems that employ several computers at various points. It should be physically possible and economically sound to place input and output devices, connected for on-line use to the heart of the system, at any user's point throughout the geographical distribution of the regional center.

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[2] The Student's Cumulative Record--Unachieved Potential. *Based upon a study conducted at the University of California, Berkeley, 1961-62, Sacramento: California State Department of Education, 1963.*

[3] A Report of a Study--Processing Pupil Personnel Data. *Bulletin of the California State Department of Education, Vol. XXXI, No. 2, March, 1962. Sacramento: California State Department of Education, 1962.*

[4] *An "on-line" system is one in which the user is directly in contact with the computer and receives an answer to his question immediately.*

Until recently, data-processing systems across the country have been confined primarily to separate school districts. After years of experimentation in California, Florida, Iowa, and Massachusetts, a growing preponderance of evidence seems to confirm the thesis that organized regional groupings embracing several school districts within a region could operate data-processing systems with good results. The general impression appears to be that a regional type of system would offer more advantages than a separate or local type, regardless of district size, and that the regional center would be particularly pertinent to systems used by small- and medium-size school districts.

Centralized Complex

The California plan of such a service involves a central data-processing complex, which includes all files of all subscribers stored on magnetic tapes, disks, and magnetic drums. Communication facilities radiating out from the center to all cities where subscribers are located will be provided for transmitting data. Specially designed devices are to be placed in school district locations and even designed to become a functional part of the school district operation. Different input and output devices could be installed for different functions of the service (counseling versus business services, for instance).

The individual school would pay for a service defined in terms of the number of students and the variety of applications. Each school district would be sharing all the central processing equipment, most of the communication facilities, and all of the attendant central expense, such as installation and programming costs.

The basic attractiveness of such a service, compared to the other sharing concepts that were involved in the early days of educational data processing, is the noninvolvement of the school districts in the central ownership problem. They can subscribe or not subscribe to all or a part of the available service as they see fit, with no long-term investment. In effect, the entire concept is practically identical to that of the home telephone service.

Advantages of the Regional System

Among the advantages of the regional type of data processing system are the following:

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[5] "Batch processing" is the type of data processing in which data are accumulated until sufficient data exist to run a "batch" through the computer.

- It is less expensive to furnish and operate one central installation for a region consisting of a number of school districts than to furnish and operate a separate installation for each of the same number of districts.
- Improvements developed at the processing center in a regional system will benefit a large number of schools, not just a few.
- A high degree of staff competency is more likely to be realized in a regional system than in a local district system.
- A greater uniformity of procedures and products can be maintained in a regional system than among separate school systems.
- The various school districts cooperating in a regional system can contribute valuable suggestions to the total effort because of the large number of participating schools and the unique differences among districts in a system.

Adoption of Workable Forms

With such availability of the information, and given sufficient professional and systems staff personnel to develop a comprehensive reporting system, it is entirely possible to abstract from the system the kinds of desirable guidance information with which counselors can make definitive decisions. An example of this information is a new type of cumulative record. This record, designed to be used in any of the 50 states, requires no additional input to a computer system for generating the report. The system is designed so that data in school districts are generated as a result of an ongoing program of guidance and instruction. A relatively low-cost mark-reading device in each school district or school building can readily communicate information from standardized tests, grade reporting, attendance accounting, student scheduling or registration, and health and psychological services to a nearby computer over regular telephone lines.

Only the information is transmitted; the documents used for recording input information, which is originally created at the computer center for master records, stay physically at the school. (Samples of the documents have been reproduced in this appendix.) As the information regarding each student is fed into the computer throughout the year, it is screened for accuracy and then used to update the student's master record, stored on a variety of magnetic devices. This updated master record can then be printed in numerous copies each semester to serve as guidance reports. The original copy, which contains all relative information, goes to the counselor. A copy can be sent to the administrative offices. A special copy can also be prepared for teacher reference. An additional copy can be mailed to the student and his parents for use as a basis for yearly conferences with the school counselor. No confidential information appears on the student copy, since that area is masked over by a special design incorporated by the form.

This form is designed to be issued at the end of each semester and can be used as a uniform college transcript as well. In addition, the form replaces

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the typical semester report card by inforporating the report card. The record also deviates from the normal transcript in that it provides for grades to be listed by subject area rather than by semester. The subject-area grade-point average is automatically computed and placed just beneath each specific area. Since dates for the completion of each course are provided, it is an easy matter to reconstruct each semester's courses and grades.

A special space is provided for reporting the latest test scores. The test-score area provides multiple interpretation of test results. In the section provided for subtest results, the publisher's method of reporting his test is listed. Across the top of the form are arranged the various percentiles from zero through 99. Corresponding to the percentiles is the stanine range, which is recorded across the bottom of the test-scoring area. By placing a series of asterisks across the test-reporting area, one can interpret a score in the fashion provided by the test publisher--in percentiles, percentile bands, and stanines. This record form is an attempt to indicate to the teacher and the counselor a unit score. It does not require the teacher to be an expert in test interpretation; but with one glance he sees a variety and a combination of scores, so that the relationship between percentiles, stanines, and the test publisher scores becomes readily apparent.

This form is prepared on one side of a sheet 8-1/2 × 11 inches and contains most of the vital data needed at both the high schools and the college admissions offices.

AUTOMATION: IMPLICATIONS FOR SCHOOL PERSONNEL

The next decade promises a revolution in the handling of information in school districts. The factors contributing to this revolution have already begun to show themselves in the past two or three years. The advent of on-line computer systems is only one of these factors.

Incorporation of automatic data-processing systems into the school scene, as noted previously, has many implications for school personnel. The major advantage lies in the production of more accurate and more up-to-date information. Shorter delays in processing can make more frequent reporting practicable. Another advantage is that of overcoming inertia. Almost everyone in a school district knows how the operations of his district can be improved, yet changes are not made for various reasons. Long overdue changes are often accomplished by the enthusiasm and the genuine effort that are nearly always generated by a study for a proposed automatic data-processing system. Some observers say that tradition is a greater obstacle than inertia to the adoption of new methods. It appears, however, that introduction of new equipment facilitates the immediate adoption of many changes that can be refined for greater efficiency, for people are often more willing to use new equipment than they are to accept new ideas.

In order for counseling programs in the next decade to move ahead as rapidly as necessary, educators will be required to make a bold start toward identifying general objectives and policies as well as identifying criteria and significant patterns of student behavior.

School districts like the Covina Valley Unified School District in southern California, under the leadership of Thomas Smith, have projected the possibility of using data processing on a daily basis through the use of communication media. If data processing can be accomplished in this manner and if the master files are available on a daily basis, it will be possible to subject the master file records to variance investigations rather frequently. Consequently, counselors can be alerted to significant variations of performance in a short time and need not wait to pour through reams of historical data traditionally generated at sporadic intervals.

Information such as this should be in a format that makes the contents so convenient for the counselor that he can carry it with him and can refer to it as the need arises. Aids can be developed to highlight variances of performance for counseling use even during the month's end printing of various reports. An irregular attendance report is such an aid. (A sample of an irregular attendance analysis report appears earlier in this appendix.)

If guidance personnel can develop an educational information system such as prescribed in the foregoing, much can be done to provide school counselors with significant information at minimum cost and with minimum delay. It is quite possible to establish general criteria for all school districts; an educational information system need not be totally unique for any one district.

Appendix B

QUARTERLY PROGRESS REPORTS, 1962-1965
COOPERATIVE RESEARCH PROJECT NO. D-050
CONTRACT NO. SAE OE 3-10-051

REPORT NO. 1, SEPTEMBER 21, 1962--DECEMBER 31, 1962

Major Activities

Training. Members of the Research and Development Center staff have completed courses in RCA 301 Programming, Systems Analysis, and Common Business-Oriented Language (COBOL). In addition, the Chief of Programming has completed a seminar on Program Evaluation and Review Technique (PERT).

Organization. The State Advisory Committee on Integrated Data Processing met in September. At that meeting, the Research and Development Center staff reported on preliminary organizational steps. With the advice and consent of the Committee, task-oriented project committees were appointed to serve in a consultative capacity for the several areas under study. Each Research and Development Center staff member was assigned to one of the committees; and the consultant, as project coordinator, will serve on each in an ex-officio capacity.

Future Activities

During the next three months, project personnel will continue working with the established committees and will activate several additional ones. Major emphasis for this reporting period will be on completing the design of the master file components. On the basis of first time estimates, the PERT chart (see attachment A) indicates that the master file design should be completed during the 1963 calendar year. All efforts will be directed toward this end.

Special Problems and Major Departures

At this point, it appears that no major departure from the original schedule will be necessary. The main problem lies in the area of not knowing, or at least not being able to project with any degree of certainty, the amount of time needed to program the master schedule. To complete and demonstrate the project by mid-1965, all programming must be finished and debugged by December, 1964. This deadline allows 12 calendar months for this aspect, assuming the master file is completed by December, 1963. The Research and Development Center staff does not know whether this time allotment is ample, adequate, or inadequate.

REPORT NO. 2, JANUARY 1, 1963--MARCH 31, 1963

Major Activities

The Research and Development Center staff has activated all but one of its nine task-oriented committees. Each committee was called into action at a time appropriate to its relationship to another committee. Most have met several times, and the goals of each are being approached systematically. Members of the final subcommittees will be called together next month. The committees, with titles appropriate to their functions, are:

Master File and Coding Systems Committee
Cumulative Records, Mark Reporting, and Test Scoring and Reporting Committee
Library and Clearinghouse Committee
Registration and Scheduling Committee
Report Analysis Committee
New Product Analysis Committee
Organization and Financing Regional Data Processing Centers Committee
Simulation Studies Committee
Education Compiler Committee (not yet activated)

Each committee is composed of educators, data processors and/or lay persons representing a cross-section of education in California. Represented are: a variety of organizational types of city and county school districts that include kindergarten through grade fourteen; the Coordinating Council for Higher Education; state colleges and universities, private universities; the State Department of Finance; several bureaus of the State Department of Education; and the State College Chancellor's Office.

During this quarter, major presentations have been made by the staff to the State Superintendent of Instruction and his Chief Deputy, the State Board of Education, and the staff of a new state college. Several conferences have been held with the personnel from state colleges, school districts, and offices of county superintendents of schools. The first of a series of regional meetings has brought together users of data processing in education. A working relationship has been established with the California Educational Data Processing Association, the major organization in the field.

In each instance, the project has received assurance of enthusiastic support.

Future Activities

During the next quarter the Master File and Coding Systems Committee will complete the first draft of the master file, and the other committees will form more definite goals. The Education Compiler Committee will become operational. Two major seminars are planned. A two-day introductory workshop in data processing for school administrators and counselors is scheduled in April. It is being cosponsored by the California Educational Data Processing Association.

A one-day invitational seminar is scheduled for early May. Invited to attend this meeting will be leading California school administrators, executives of the major educational organizations, state and federal legislators representing the Sacramento area, and legislators on key committees affecting education.

These two seminars will begin a proposed series of meetings to be scheduled in various areas of the state. Other meetings will be scheduled to discuss specific problems in data processing.

REPORT NO. 3, APRIL 1, 1963--JUNE 30, 1963

Major Activities

The first phase of the research and development project progressed as planned during this last quarter. The master file has gone through its second revision, and the final draft now must await reports from the users of the file--the committees on Registration and Scheduling, Report Analysis, and Cumulative Records. These and all other committees have continued to meet, and most have their goals well defined.

Work is continuing on the course coding system. Considerable progress has been made, but much remains to be accomplished before a workable, compatible, comprehensive system is reached. Staff members are coordinating their efforts with the largest school district in California, the State College Chancellor, and the bureaus of Secondary Education and Junior College Education of the State Department of Education.

Two major seminars for school executives have been held, one in southern and one in northern California. These two-day workshops, jointly sponsored by the Research and Development Center, the California Educational Data Processing Association, and the host office of the county superintendent of schools, were well received by the representative groups attending. Plans have been made to hold similar workshops during the next school year. Staff members have continued to meet with groups interested in data processing, and several school districts have asked for consulting assistance.

The programmer analyst working with the Registration and Scheduling Committee attended the week-long workshop at Massachusetts Institute of Technology on their GASP program for registering and scheduling students.

Future Activities

The next quarter the staff will devote less time to committee meetings and more time to (1) the analysis and utilization of committee reports; (2) the refining of committee objectives; (3) the reevaluation of long-range project goals; and (4) the systems work needed to reach these goals. The work of the Report Analysis Committee will receive particular emphasis, since this group will define the types of data needed for all basis and special educational intelligence reports.

The last committee to be activated, the Education Compiler Committee,will meet for the first time this summer.

Staff members are scheduled to continue their consulting activities with individual school districts throughout the state.

Special Problems and Major Departures

The one-day invitational executive seminar for top school administrators, representatives from professional education and data processing organizations, and legislators was postponed indefinitely--until the staff have completed more of their project work. Instead of holding the seminar, the staff will work with the administrative organizations in presenting a picture of the Research and Development Center, and of data processing in general, at each of the 16 regional meetings scheduled for the coming year.

REPORT NO. 4, JULY 1, 1963--SEPTEMBER 30, 1963

Major Activities

Summer vacations curtailed the work on the research and development project. As many committee activities tapered off, however, staff members were able to review the total project, evaluate the work completed, and plan for the work that remains in the development of the total system design. Considerable interest has been demonstrated over the various coding systems that will be an integral part of the total system, and the staff are pursuing both common and compatible concepts with those who will be using these systems.

Participants at a regional meeting on school-college communication expressed a greal deal of interest in this potential of the research and development system.

The last of the task-oriented groups, the Educational Compiler Committee, was convened to discuss the language problem. After considerable discussion, the Committee recommended that COBOL be used as the basic programming language for the research and development project.

An exploratory meeting was held with the major equipment vendors to discuss the specific input-transmission-output needs of schools as related to the research and development project. Several companies have expressed interest in working with the staff in the development of satisfactory devices. Follow-up meetings have been held with individual representatives, and it appears that appropriate devices may be available when needed.

Future Activities

In the next quarter a concerted effort will be made to complete the remaining segments of the total system design. The various coding systems will be prepared for pilot use, and the tentative draft of the master plan for processing pupil personnel data will be presented for evaluation. Programming will begin as soon as the various applications have been flowed and integrated. Consulting activities will continue at an expanding rate. School districts are very interested in having their educational data processing activities mesh with the project's long-range plans.

The role of data processing will continue to be discussed by staff members at the various regional meetings of superintendents and administrators.

A one-week "brainstorming" seminar will be held in late October to define the typical reports needed by various staff members to operate an effective educational intelligence system. Several education specialists will join the regular staff for the week's work.

Special Problems and Major Departures

The main problem foreseen is that of completing the first draft of the total system by December 31. Many segments have not been defined clearly enough for design purposes.

REPORT NO. 5, OCTOBER 1, 1963--DECEMBER 31, 1963

Major Activities

Considerable staff time has been devoted to systems analysis during the last quarter. Document, character, and optical scanning hardware is being marketed at the present time, and some of these devices might meet the project needs for input. However, actual delivery dates, plus necessary make-ready and checkout time, preclude their consideration. The staff have concluded that the initial system will be oriented for card input, while the second phase system will be constructed for document input. Although this two-phase operation was not easy to accept, the staff feel the decision is realistic. Because of the current state of data processing and the lead time necessary for demonstration, the first phase system will be developed for trial by 1965.

Basic to both the first and second phase systems is the series of reports generated in a November workshop. Specialists from the field worked with the Research and Development Center staff to explore the informational needs at all levels of school operations.

The uniform course coding system is continuing to be explored by the Department of Education and many field units. Refinements and modifications have been made, and more are expected prior to a field test by at least a dozen secondary schools this year.

Also being explored is the possibility of assigning permanent numbers to schools. These numbers would satisfy identification requirements at all organizational levels.

Staff members have continued to travel throughout the state, speaking to administrative groups and consulting with specific school districts. Audio-visual and curriculum groups have expressed interest in the project. A working arrangement has been established with the Audio-Visual Education Association of California, the statewide audio-visual group, as they explore educational data processing possibilities in their field.

Future Activities

Projected activities center on completion of the total system specifications. Considerable staff time will be devoted to this. As the system becomes better defined, some of the research and development committees may be called into action.

Work on the various coding systems will carry a high priority. Educational data processing will continue to be discussed by staff members at various regional meetings, and consultations should continue unabated. When the system is finally defined, the next operational phase--programming--will begin. This phase should get well under way during the next quarter.

Special Problems and Major Departures

Staff efforts to complete, by December 31, investigations of the various applications being considered as part of the total integrated data processing system have not been successful. It now appears that the original PERT target date will be reached sometime in February. This departure from the projected schedule should not cause any serious problems, since the final outcome will rest on the foundation established at this time. The other problem--that of hardware--has been mentioned earlier in this report.

REPORT NO. 6, JANUARY 1, 1964--MARCH 31, 1964

Major Activities

Activities this quarter have continued to center on system development and input-output content and format. Availability of small-scale optical scanning devices earlier than anticipated has restructured the input aspect of systems work, and documents now are being designed to utilize them. The output reports have been modified several times to present information in formats that can be understood more easily. These changes have resulted from recommendations from the State Advisory Committee on Integrated Data Processing and subsequent staff meetings. The report forms are not yet ready for circulation.

Work has continued on the course coding system. Meetings with Department of Education administrators have resulted in continued support of this concept. Other meetings have been held with county and research groups, and all have affirmed their belief in this as a desirable course to follow.

Staff members have traveled to many points in California for speaking engagements and to the American Association of School

Administrators convention in Atlantic City, the Oregon Computer Conference, the American Personnel and Guidance Association convention in San Francisco, and the California Education Research Association convention in Santa Barbara.

The Research and Development Center staff was represented at a meeting in Washington called by the U. S. Office of Education to plan the development of a handbook on data processing and guidance.

Lines of communication were extended through an all-day conference with USOE specialists in education records and reports.

Cooperative efforts with the California Educational Data Processing Association have resulted in the establishment of several regional groups that meet regularly to discuss and investigate EDP activities in education.

Future Activities

Future activities include a two-week workshop with curriculum specialists to specify the content areas of the course coding system; two two-day school executive seminars on EDP for the Orange County Office of Education; active participation in the Association for Educational Data Systems convention in April; continued work on the total system design and input-output documents; continued writing and speaking sessions for the advancement of wise use of data processing in school information systems; and continued intensive work to complete system and document design.

Special Problems and Major Departures

The loss of the Chief of Programming through his promotion to Data Processing Manager for the Department of Education caused some reassignment of project responsibilities. Some deviation from the planned completion dates of systems and report design has resulted.

REPORT NO. 7, APRIL 1, 1964--JUNE 30, 1964

Major Activities

This quarter has seen continued emphasis on the refinement of the data processing system for pupil personnel and curricular information. The system design is in a semifinal form as are the input-output documents. Meetings with the State Advisory Committee on Integrated Data Processing and several project committees have resulted in minor but important changes, which should lead to a more precise operational setting and more usable documents.

The course coding system has continued to develop. The State Department of Education is taking action to involve educators statewide in the final specification for the code, a catalog of course descriptions, and steps for implementing the system. The Research and Development Center staff also have worked with a top-level committee in establishing a permanent number for each school in California.

Several seminars on the concept of regional information centers have been held with county superintendents of schools. Acceptance of this method or organization is growing.

Writing and speaking activities have continued this quarter. The staff have participated in the Association for Educational Data Systems' national conference in Santa Barbara, several California Association of School Administrators' and California Association of Secondary School Administrators' meetings, a seminar for school administrators in Orange County, the College Student Personnel Institute workshop on EDP, the Los Angeles County Workshop on EDP, and several college and university presentations on EDP in education information systems.

Future Activities

Scheduled for the next quarter are two statewide meetings to present the course coding concept to educators in the field; tentative completion of the system, and input-output documents for the project demonstration; continued publication and speaking engagements; and completion of specifications for the first retional center operation.

REPORT NO. 8, JULY 1, 1964--SEPTEMBER 30, 1964

Major Activities

Emphasis this quarter has been placed on the development of equipment specifications for the first regional data processing center. These specifications were released to vendors in August, and eight proposals were received prior to the September deadline. These proposals were evaluated by the Research and Development Center staff, the staff of the Office of the Sacramento County Superintendent of Schools (which will become the first regional center), and commercial consultants specializing in electronic data processing systems and hardware. A Honeywell 200/300 computer complex was selected by unanimous agreement.

The Center staff have continued to refine the system, programs, and input-output documents for the project demonstration, which will begin after the first of the year.

Investigation of input devices has continued. A low-cost, high-speed, flexible-format document reader is being developed for the project. This reader will be demonstrated early next year.

Work on a uniform system of course description and coding that might be adopted for statewide use has continued. Staff members met with school district superintendents in two exploratory meetings. These meetings resulted in the formation of the California Curriculum Compatibility and Course Coding Committee, which has held three meetings to date.

Future Activities

Work will continue on a course description and coding system that might be adopted for statewide use. Meetings are scheduled to define the basic descriptive elements that will then be used to develop a master curriculum catalog.

Design of input-output forms, systems design, and programming will be completed this quarter in preparation for the demonstration that is scheduled to begin in January of 1965.

Plans will continue to be developed and systems defined for the first regional center.

Members of the staff are scheduled to participate in a number of conferences, and additional school executive seminars are being planned. Several articles on the project are being prepared for publication.

REPORT NO. 9, OCTOBER 1, 1964--DECEMBER 31, 1964

Major Activities

This quarter brought the developmental aspects of the project to a close. The various subsystems have been completed and are now being piloted for use in the first two of the 12 projected regional centers in California. Forms have been designed for pilot use. The systems and forms have been readied for the demonstration of the project for school administrators and board members. These day-long demonstrations will take place on the first Tuesday of each month, January through June, 1965.

The Curriculum Compatibility and Course Coding Committee's efforts have continued, and steps were taken to develop a catalog of all courses offered in California.

Three systems specialists from the Honeywell Corporation joined the Center staff, and the IBM 1232 optical reader was delivered. Orienting the new staff members and getting oriented to the new device represented a major investment of time.

Greatly increased interest in the regional data center concept required an expanded schedule of field visits. The enthusiastic acceptance of this concept will accelerate the implementation plan so that 12 centers will be operating by 1970. Planning the orderly transition from manual or punch-card applications to an integrated total system has required additional meetings with educators in areas concerned.

Continual seminars have allowed the staff to reach the many educators who will be affected by these new systems.

The staff was pleased to receive visiting educators from the U.S. Office of Education and several states and delegations from the Dominion of Canada and Sweden.

Future Activities

In the next quarter the staff will concentrate on the monthly project demonstrations, course description and coding, the piloting of the system in selected schools, the planning of the regional centers, and the continuation of seminars, writing, and speaking. The final report on the project will be started.

REPORT NO. 10, JANUARY 1, 1965--MARCH 31, 1965

Major Activities

Emphasis this quarter has been placed on the programming and field testing of the subsystems comprising the total integrated pupil personnel system. The attendance and scheduling programs are in the final testing stages, and the mark-reporting and test-scoring programs are being prepared for initial test runs. Input-output design has been completed for most forms, and reactions have been received from potential users of some of these forms.

The project demonstrations, scheduled for the first Tuesday of each month, have been well attended by top administrators and board members. These demonstrations will continue through June.

A two-day workshop on test scoring and processing was held. Further definition of problems in this area was reached.

A "flying seminar" from Oregon was received by Research and Development Center staff and the Sacramento Regional Center. This group of approximately 40 educators visited the regional center, and while they were at the center two plans and achievements of the research and development project were described to them by members of the project staff.

Criteria for the establishment of regional centers have been developed. When they are approved by the State Advisory Committee on Integrated Data Processing, they will be released to the field.

An inclusive statement on regional centers has been developed. It describes the rationale for such centers and criteria and procedures for establishing the centers.

Considerable staff time has been devoted to meeting with school district and county educators interested in establishing regional centers. It appears that at least three new regional centers will be in operation by 1966, and that the projected 12 will easily become a reality by 1970.

The Honeywell Corporation has provided additional support to the project with systems personnel and will provide an H-2200 computer, upgrading the earlier configuration of an H-200 and H-300. Honeywell also has offered to underwrite a nationwide seminar series to disseminate information about the Research and Development Center's project.

Course description activities have continued. The Associate Project Director participated in a one-week technical conference in Washington, D.C. where he was familiarized with the work in this area that was being done by the U. S. Office of Education.

Future Activities

The next quarter will bring the three-year Research and Development Center Project to a conclusion. All systems will have been completed, documented, and field tested through the cooperating school districts. The systems will then be released officially to the first two regional educational data centers for operational use with records of more than 200,000 public school pupils.

The final project report will be completed and submitted to the U. S. Office of Education. An abstract of this report will be prepared for distribution to educators in the field.

Appendix C

LEGISLATION ON REGIONAL EDUCATIONAL DATA PROCESSING CENTERS

Senate Bill No. 1291

CHAPTER 2037

An act to add Chapter 9 (commencing with Section 9181) to Division 7 of the Education Code, relating to regional data processing centers.

[Approved by Governor July 17, 1965. Filed with Secretary of State July 23, 1965.]

The people of the State of California do enact as follows:

SECTION 1. Chapter 9 (commencing with Section 9181) is added to Division 7 of the Education Code, to read:

CHAPTER 9. REGIONAL EDUCATIONAL DATA PROCESSING CENTERS

9181. The governing board of a school district and a county superintendent of schools may establish and maintain educational data processing centers. Such centers that meet the requirements of Section 9185 for eligible regional educational data processing centers are entitled to financial assistance from the state for the purpose of such centers as provided herein.

9182. A regional educational data processing center may consist of any of the following:

(a) One educational data processing center maintained by the governing board of any school district having an average daily attendance of 100,000 or more pupils.

(b) One educational data processing center maintained by the county superintendent of schools that provides data processing services to two or more school districts, within or without the county, having a combined average daily attendance of not less than 100,000 nor more than 300,000 pupils.

9183. The governing board of any school district may contract with any county superintendent of schools for the rendering to the schools of the district of data processing services and may pay for the services out of any funds of the district.

9184. The functions of regional educational data processing centers shall include the processing and reporting of information relating, among other things, to programs of instruction, school business administration, and pupil personnel data.

9185. An eligible regional educational data processing center is one that meets the following requirements:

(a) It possesses equipment, personnel and funds sufficient, as determined by regulations of the State Board of Education, to convert and correlate basic source material into data processing form by use of a basic data system.

(b) It is a regional educational data processing center as defined in Section 9182.

(c) It meets the minimum standards established by the State Board of Education.

9186. The State Board of Education shall adopt rules and regulations necessary to implement the provisions of this chapter, including rules and regulations that:

(a) Establish minimum standards entitling regional educational data processing centers to receive an allowance under this chapter.

(b) Prescribe the procedure by which applications for allowance pursuant to this chapter shall be governed.

9187. The Superintendent of Public Instruction, upon proper application therefor made by a school district or county superintendent of schools maintaining an eligible regional educational data processing center, shall allow to the applicant the amount specified in this section appropriate to the fiscal year for which the application is made.

(a) The amount of an allowance for which application may be made shall not exceed $30,000 for the first, $20,000 for the second, and $10,000 for the third, fiscal year for which an allowance is sought.

(b) An allowance shall be made for each of any three fiscal years for which a proper application is made by a school district or county superintendent of schools maintaining an eligible regional educational data processing center.

(c) A school district or county superintendent of schools shall not receive more than one allowance in any fiscal year nor more than three such allowances altogether.

(d) A new application shall precede such allowance.

9188. The Superintendent of Public Instruction shall make the allowances to school districts and county superintendents of schools pursuant to Section 9187 from any funds which may be provided for such purposes under any program established by or under authority of federal law.

Appendix D

REGIONAL EDUCATIONAL DATA PROCESSING CENTERS IN THE STATE OF CALIFORNIA[1]

The work of the State Pilot Project in Educational Data Processing in Richmond from July, 1960, through June, 1963, and the continuing efforts of the Research and Development Center in Educational Data Processing in Sacramento have proved that a regional cooperative venture in educational data processing is not only possible but workable. Until recently, data-processing systems in California had been confined primarily to separate school districts. After three years of experimentation, however, the State Pilot Project concluded that (1) large districts--those with 30,000 or more average daily attendance--and (2) organized regional groups embracing several districts within each region could operate data-processing systems with foreseeably good results. It was further concluded that a regional type of system would offer more advantages than would a separate or local type, regardless of district size, and that the comparison is particularly pertinent to systems used by small- and medium-size districts.

ADVANTAGES OF A REGIONAL SYSTEM

Among the advantages of a regional type of educational data-processing operation are the following:

- It is less expensive to furnish and operate one central installation for a region consisting of a number of school districts than to furnish and operate a separate installation for each of the same number of districts.

- The benefits derived from the learnings, developments, and improvements that take place at the processing center in a regional system can be applied to a large number of schools, not just to a few schools.

- A higher degree of central staff competency is more likely to be realized in a regional system than in a multitude of local district systems.

- There is greater uniformity of procedures and products in a regional venture than can be found among separate district systems.

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[1] *Reprint of* Regional Educational Data Processing Centers in the State of California. *A Publication of the Research and Development Center in Educational Data Processing. Sacramento: California State Department of Education, 1964.*

- The various districts cooperating in a regional system can contribute valuable suggestions to the total effort. This is true because of the large number of schools participating and the unique differences existing among the districts in the system.

Data-processing systems in scattered school districts in California have been developed rather haphazardly during recent years to meet the pressing needs of each local situation. Despite the hard work of the systems personnel in these districts, certain problems have been known to generate trouble--for example: inefficiencies due to inadequate equipment and/or a lack of sufficiently trained personnel, failure to integrate properly the data-processing applications with the district's educational program, and excessive involvement with needs of the moment at the expense of well-planned procedures that would take care of many needs over a reasonably long period of time.

In a regional type of venture, however, these problems would be minimized or would probably be removed altogether. Much more thought, for example, would be given to integrating the data-processing operations with the education programs everywhere in the region served.

Any educational data-processing system, whether district or regional, can run into serious difficulties (1) if the developmental phases of the processing program are not consigned to competent, well-trained personnel; and (2) if quick and effective methods of communication between the center's staff and the schools are not established from the outset.

Moreover, the willingness of system participants to work out mutual problems, to cooperate, to compromise if necessary, to consider the progress of all users rather than the gain of a few--this is indispensable to the healthy functioning of a regional data-processing system.

CLIENTS FOR REGIONAL CENTERS

The regional center should be considered a service organization. Its primary function should be that of providing data-processing services which cannot be efficiently maintained or operated in local districts. On the basis of practical administration, regional centers can successfully handle the processing of data originating in three major types of districts: small, medium, and large school districts.

Small Districts. Small school districts of less than 10,000 average daily attendance may wish to send original source documents (business office, payroll and inventory records, teacher certification information, instructional and pupil data such as machine-scorable test answer sheets, registration materials, attendance-accounting records, mark-reporting rosters, etc.) directly to the regional center for processing. These districts typically do not have sufficient volume to warrant the purchase and use of their own data-processing equipment for handling these materials; they could obtain data-processing services for less financial cost and with greater speed than by manual methods. For such districts a regional center could offer tangible ways of meeting their needs.

Medium-Size Districts. Medium-size school districts of from 10,000 to 30,000 average daily attendance typically find justification for minimal data-processing equipment. The term "minimal" refers to that equipment which is necessary to convert information on source documents into punch-card or tape form. In the field of testing, the typical example is a district having a scoring machine, a key punch, and perhaps a sorter, a reproducer, a tabulator, and an interpreter. This equipment allows for punching the data onto cards, sorting information for desired groups, and printing rosters of results. Such a district could then submit punch-card data to the regional center for specialized compilation, tabulation, and distribution and for special reports and analyses.

Large School Districts. Large school districts maintaining a fairly complete line of data-processing equipment that allows for a number of operations, including the conversion of basic source material into data-processing form, would frequently find it desirable to utilize a regional center for student scheduling, special computational analyses, and complex statistical analyses of data.

PROCESSING PROCEDURES AND REPORTING METHODS

A planned structure of regional processing procedures and reporting methods should, desirably, be developed by consensus of the school districts participating in the regional system. Uniformity of processing design will invariably result in economy, greater speed, and reliability. One of the major responsibilities of the regional center would be to offer coordination and leadership in effective and reliable methods of handling (1) pupil personnel data and (2) information in other important areas. Local reports for cumulative records could be made compatible with the data-processing system to be utilized in the regional operation, and this would facilitate inter- and intra-district exchange of pupil information.

SUGGESTED CRITERIA FOR THE ESTABLISHMENT OF REGIONAL CENTERS

The following criteria and/or determinants are suggested for the serious consideration of offices of county superintendents of schools and school districts that wish to establish a regional center for processing educational data. These criteria have been derived almost entirely from practical field experience.

- Adequate Student Population. Estimates by the staff of the Research and Development Center in Educational Data Processing, based on field observations, the Richmond Pilot Project, and projections from the Sacramento and Ventura offices of county superintendents of schools, indicate that a desirable student population serviced by a center will vary between a minimum of 100,000 and a maximum of 300,000.

- Administrative Commitment. It is anticipated that no center will be able to function efficiently and effectively without the support of the top administrators (Superintendent, Board of Education, and when appropriate, the Board of Supervisors) in each of the user school districts. This support should be active rather than passive, because an indifferent approach by the administration may encourage the development of less than the full potential of the system.

- Demonstrated Interest. School districts and offices of county superintendents of schools should initiate activities in school information systems, rather than have their interest prodded by the R/D staff.

- Desire to Develop Compatible Systems. An added and greatly needed feature in school information systems is that of compatibility with other educational systems. The data must be in units that would make possible the exchange of comparable information with other school districts, offices of county superintendents, the State Department of Education, and other agencies. The interchange of data is desirable within subsystems on an integrated basis (e.g., test data and achieved marks) at the local level, and it also is desirable to exchange appropriate data with other school districts, offices of county superintendents of schools, and the State Department of Education. Compatible systems will relieve educators of many of the clerical aspects of data preparation for exchange by shifting this burden to machines.

- Geographic Location. The site of a regional center should be such that it is accessible for necessary meetings, inservice training, data delivery and/or pickup, etc. Cooperative efforts can be enhanced by a proper selection of the center site.

- Availability and Cost of Conversion of Physical Facilities. The facilities needed for housing a center should be located within existing educational structures. The cost of converting these to meet hardware (wiring, temperature, humidity, floor capacity, etc.) and other operating specifications (storage, classroom availability, etc.) must be considered.

- Operation by an Intermediate Unit. Most school districts are neither equipped nor staffed to service other districts. Intermediate units, the offices of county superintendents of schools, have primary responsibility for this function. Areas considering regional efforts should be organized under the unit that best can develop, organize, and administer a regional operation.

- Willingness to Share Total Costs. The support of a regional center entails more than the cost of direct services to the pupil. Site preparation, maintenance, and all other overhead expenses must be considered.

- Leadership Personnel Available. Each center also needs a top administrator (i.e. assistant superintendent) to assume overall responsibility for the success of the center. This person needs an understanding of EDP concepts so that he will appreciate the problems and possibilities as they are presented by the user and the staff.

- Direct Top Administrative Support by the Intermediate Unit. The administration of the unit housing a center must be totally committed to regional cooperation and educational data processing. Without this, the superintendents and/or the board of education may find it necessary and/or more convenient to let regional problems slide, much to the detriment of the program.

- Ability to Finance the Program. A regional center requires a minimum yearly budget of $185,000. These funds may be from any legitimate source--county government, state, local district, etc.

- Willingness to Promote Uniform Practices to Improve Efficiency in Educational Data Systems. School districts served by a center must be willing to use certain proven basic data systems, such as those developed by the R/D staff, or be willing to finance the development of their own system so that the data will be compatible with the R/D format. This will obviate the need for a great deal of costly research and systems development, and will permit a more rapid extension of services to schools within the region. These basic systems will provide the means for better data exchange and report simplification. Local programs above and beyond the basic system would be developed by the center at the expense of its users.

BY-PRODUCT SERVICES

The regional type of processing center can offer substantial by-product services--for example, the compilation of common types of pupil personnel records for research and analysis. The center can provide unbiased and confidential analyses of data pertaining to educational functions in many school districts. Being the depository for regional information, the center is in a position to conduct various significant studies of broad regional scope, such as salary surveys and certification analyses.

REGIONAL STEERING COMMITTEES

It has been found that a realistic, practical method of maintaining uniformity and workability of operations in a regional EDP center is the guidance rendered by a "regional steering committee." Such a committee (1) is typically composed of personnel from the school district and office of the county superintendent of schools with well-defined leadership qualifications; and (2) gives active assistance to the regional center in terms of policy, operation, and guidance. Of basic importance, of course, is a policy statement which should be drawn up before the committee goes into action. The following statement by an existing steering committee is typical. There will be variations throughout the state as new regional centers are established, but all policy statements should strive for uniformity and compatibility of services rendered.

Policy Statement: Sacramento Regional Educational Data Processing Steering Committee

The Sacramento Regional Data Processing Center is established through the cooperative efforts of participating school districts and offices of county superintendents of schools in several counties, the California State Department of Education, and the U. S. Office of Education.

The purpose of the Center is to provide educational data processing services to the school districts of the region.

The Center is under the direct administration of the Sacramento County Superintendent of Schools and the Sacramento County Board of Education. The Sacramento County Superintendent of Schools and the Sacramento County Board of Education recognize that the cooperative nature of this service demands that the policies governing the administration of the Center must reflect the wishes and needs of the districts being served.

Therefore a committee that is representative of the school districts being served by the Center has been established to develop and recommend, to the Sacramento County Board of Education and the Sacramento County Superintendent of Schools, policies that will govern the administration of this regional educational data-processing center. Listed below is an outline of the organization and functions of the Committee that will determine the policies recommended for the operation of the Sacramento Regional Data Processing Center.

I. Name of Committee:

The name of the policy-determining committee shall be "The Sacramento Regional Educational Data Processing Steering Committee."

II. Committee Membership:

A. Voting members:

1. There shall be seven members.
2. Each member shall be elected at large by all the representatives of participating school districts that are contracting for services from the Regional Data Processing Center.
3. Candidates for election shall be district or county office of education personnel who have administrative responsibility for data processing in their respective school districts or county offices of education.

B. Nonvoting members:

1. The Assistant County Superintendent of Schools, Sacramento County, Chairman of the Committee
2. The Director and the Manager of the Regional Data Processing Center
3. Representatives from the Research and Development Center in Educational Data Processing, California State Department of Education
4. Members of advisory committees that may be organized for special data-processing programs in areas such as business, curriculum, audio-visual aids, the school library

C. Term of membership:

The members shall be elected for three-year terms, two members elected each year and three members elected every third year. (Note: Prior to the present revised policy statement, there were five elected representatives to the Steering Committee.)

Starting January, 1965, two Committee members will continue their terms until January, 1966, and one member will continue his term until 1967. Of the four new members elected in December, 1964, two will serve terms expiring in January, 1967, and two will serve terms expiring in January, 1968. Lots will be drawn to determine which members will serve terms expiring in 1967.

Newly elected members shall become active on the first day of January subsequent to their election in December of the immediately preceding year.

D. Officers:

The Assistant Superintendent of Schools, Sacramento County, will serve as Chairman of the Committee and shall be responsible for keeping accurate minutes of the meetings and sending out notices of regular and special meetings.

E. Regular meetings:

The Committee shall meet regularly on the morning of the first Tuesday of every month. Special meetings may be called at the discretion of the Chairman.

F. Annual meetings of participating school districts:

On the second Tuesday in December, the administrative heads of all participating school districts shall meet for the purpose of hearing reports on data-processing services by the Center and to hear of proposed new services for the succeeding years.

This group shall have the responsibility for electing members to the Steering Committee and to review and approve the charges to be made to school districts for the succeeding year. Each administrative head of a participating school district and each county superintendent of schools present at the meeting shall be entitled to one vote.

III. Functions of the Steering Committee:

A. To develop rules and regulations governing the operation of the Steering Committee

B. To develop policies for recommendations--to be made to the Board of Education and to the administrative staff of the Office of the Sacramento

County Superintendent of Schools--concerning the operation of the Regional Data Processing Center

These policies shall be concerned with the following:

1. Determination of the extent of the services to the users of the system
    a. Addition of new services
    b. Deletion of existing services
    c. Quantity of services
    d. Addition of new school districts or new county offices of education to the service region

2. Determination of the annual budget for EDP services

3. Determination of EDP procedures to be followed by contracting school districts and by operators of the Center's machine room and equipment--such procedures to be drawn up in written form

4. Determination of staffing for the Regional Data Processing Center

5. Determination of plans for the improvement of data-processing facilities, including the addition or deletion of hardware capabilities of the Regional Center

IV. Organization of the Service:

A. The Assistant Superintendent of the Sacramento County Office of Education, subject to administrative direction from the Sacramento County Superintendent of Schools, shall:

1. Provide administrative direction to the staff of the Regional Center and make recommendations to the Sacramento County Superintendent of Schools and the Sacramento County Board of Education regarding the staffing and operation of the Center

2. Develop and administer the budget for the data-processing services

3. Develop and initiate service contracts between the Center and the contracting school districts, between the Center and county offices contracting on behalf of school districts, and between the Center and other agencies

B. County coordination:

Each participating county office of education shall appoint a staff member as an educational data-processing coordinator whose responsibilities shall be:

1. To represent his respective county on a regional committee of county educational data-processing coordinators

2. To organize and provide leadership as necessary, with the school districts in his respective county, regarding the use of educational data processing

3. To expedite the movement of EDP materials in and out of the schools of the county

4. To discuss possible new EDP applications with school district personnel and make recommendations to the Coordination Committee

5. In cooperation with the Director of the Center, to plan and conduct inservice meetings with district personnel in his respective county

SPECIAL CONSIDERATIONS FOR REGIONAL CENTERS

The following special considerations are proposed for the benefit of regional educational data-processing systems:

- Charges for Services. The charges for services rendered by cooperatively shared data-processing facilities are best based upon the actual costs of operation. Processing centers that are administered, planned, and maintained by public education funds need not operate at the profit that is necessary to private enterprise. Considerable financial savings are possible if appropriate educational groups or agencies are formed to secure maximum and efficient use of the processing equipment. Educational data-processing units are not established to do contract work for individuals, nor are they in competition with private enterprise. They represent an efficient service organization, the purpose of which is to provide with greater speed and accuracy and at lower cost the machine-processing of heretofore manually processed data.

- Channels of Communication. Continuous communication must be maintained between individuals utilizing pupil personnel records and the data-processing center. Questions concerning the accuracy or meaning of data may recur despsite the fact that the same forms and procedures may have been used over a period of years. With any change in form or in methods of reporting data, thorough inservice activities must be conducted if the data are to be accurately reported on source documents and appropriately utilized.

- Administration of the Regional Center. The administration of any regional data-processing center must be under the direct supervision of a central administrative officer. Without sufficient authority and proper judicial powers on the part of the administrative head of the regional system, data-processing operations may be subjected to "pressure politics" in which favioritism, calamity, or expediency could destroy established procedure, nullify priority, and throw time schedules into confusion.

- Ownership of Materials. Materials handled by the data-processing unit may not become the property of the data-processing center. As a service unit within an educational system, the data-processing group should provide assurance that data will be accurately and efficiently processed and that the results will be returned to the submitting school or agency as its own property for distribution and interpretation. The processing center can well be the custodian of the source information, documents, cards, and tapes but never the "owner." With the exception of certain types of attendance accounting for financial reimbursement, as well as state testing program data, school data should not become public information and should not be available for general distribution or interpretation without the consent of the school or administrative officer responsible for the data.

- Periodic Conferences. Periodic meetings of data processors and personnel from participating schools and offices of county superintendents of schools for the purpose of compiling suggestions and evaluations should be a necessary function of any regional processing unit. While data-processing centers should not dictate what records will be maintained, it is also true that school personnel may not be able to visualize the most advantageous form or analysis of data through which the processing center can economically and quickly produce the desired end results. Such conferences will help the processors and the school personnel to achieve mutual benefits.

HOW TO ORGANIZE A REGIONAL EDP CENTER

Experience has taught that a regional center for educational data processing cannot be brought into being by action of the county superintendent of schools alone. When decisions involving a regional system are made at top administrative level and are then filtered down through the ranks, school districts often react negatively by resisting the program and showing an unwillingness to cooperate in the system. A project of this value and magnitude cannot be organized simply for the sake of organizing it. Its sights must be set on the schools--their staffs and their students. Its goal must be that of helping education.

It follows, then, that cooperation must be the keynote. Although spearheaded by the orginating office of the county superintendent of schools, a regional system needs to be based on the clear-headed understanding, mutual planning, and enthusiastic efforts of all the prospective users.

Suggested Plan of Organization. Over a period of years the staff of the Research and Development Center in Educational Data Processing, State Department of Education, has worked cooperatively with offices of county superintendents of schools, and school districts throughout California in evolving a workable scheme of organizational planning and action for regional centers. This plan consists of the following practical steps, which may serve as guidelines for those who are interested in the regional concept:

- The first step is usually that of holding a meeting for the purpose of discussing the regional center concept. To lay the groundwork, representatives of the office of the county superintendent of schools typically contact the director of the Research and Development Center in Educational Data Processing, Sacramento, and request that such a meeting be arranged. The county superintendent of schools then invites all the top personnel

- of his staff and, if possible, one or more members of the county board of education to attend. When the conference takes place, every effort is made by the State Department personnel to impart whatever information is needed for basic planning.

- If, as a result of this meeting, the members of the office of the county superintendent of schools feel they wish to move ahead, the next step is to contact adjoining and nearby offices of county superintendents of schools and arrange a joint meeting of those staffs wishing to participate in a regional venture. A representative of the Research and Development Center would help to coordinate this second conference.

- If agreements are reached among the offices of the county superintendents of schools to work cooperatively in the proposed project, the next task--a highly important one--is to conduct an overall informational meeting to which all school district superintendents and other school administrators in each interested county are invited. The need for district cooperation and the benefits that would accrue to the schools in a regional enterprise of this kind would be keynotes of the meeting.

- With the assistance of the Research and Development staff, local meetings in each county would then be held to clarify the regional center concept, to encourage school district participation, to discuss details of services and costs, and to supply any other information that might be needed.

- When sufficient interest is shown throughout the region to warrant moving ahead, the parent county, which is usually the one to house and administer the center, should then introduce the topic of a regional data-processing system at the next meeting of the county board of education; this would be done to secure the authorization needed for drawing up plans for the center and preparing a tentative budget.

- Final plans and a budget for the proposed center are presented to the county board of education. Approval is secured.

- Next in the process would be the hiring of a director for the regional center and allowing him, in turn, to hire his data-processing manager at least six months prior to the center's opening.

- Contracts for services with school districts should be prepared and signed.

- A document detailing the scope and extent of cooperation and assistance that should be received from other offices of county superintendents of schools in the region should be drawn up. The document must be approved by all parties concerned.

- With the guidance and cooperation of the Research and Development Center, decisions should be reached as to the equipment that will be necessary and appropriate to carry out the new center's objectives.

- The parent county and the cooperating counties should then select and design the data-processing site.
- With the help of the manufacturers chosen to supply the needed equipment, (a) a timetable for delivery of the computer and related equipment should be planned; and (b) the timetable for site preparation should be finalized.
- A policy committee, or "steering committee," should be established along the lines suggested earlier in this report.

  School districts participating in the system should be asked to appoint district coordinators.
- Cooperating offices of county superintendents of schools should be asked to appoint county coordinators.
- A professional educator with background in counseling and guidance and educational data processing should then be hired to serve as assistant to the director of the regional center. This person would have primary responsibility for the testing program and also would be responsible for inservice training.
- All plans should now be finalized in cooperation with the elected steering committee and the staff of the Research and Development Center.
- A volunteer school district should be selected, and pilot operations in cooperation with an already established data-processing center should be launched. This phase is intended to test the plans, systems, and procedures that have been devised for the new center. The location for this phase, moreover, serves as an in-training site.
- Actual operations at the new center should commence with a limited population for the full range of proposed services.

It should take approximately 18 months to proceed from Step 1 to the time the new center is "on the air."

Suggested Staffing Pattern for Regional Center. The following is a suggested staffing pattern for a typical regional data-processing center:

1. The director (professional educator with experience in data processing)
2. Assistant director or consultant (professional educator who may have limited experience in educational data processing)
3. Manager of educational data-processing services (a technician)
4. Two console operator/programmers
5. One document reader and/or key-punch operator

6. A secretary

7. A control clerk

ANSWERS TO TWELVE BASIC QUESTIONS ABOUT REGIONAL DATA-PROCESSING CENTERS

In the relatively new field of educational data processing, many questions are apt to arise about its purposes, its functions, its operations, the kinds of equipment it requires, the personnel involved, budgetary costs, the benefits that can be realized from it, and so on. As the need for cooperative effort becomes greater, questions from school people about the regional center concept are being asked with increasing frequency. The following section attempts to answer some of the most basic questions in this field of inquiry.

What Is a Regional Center for Processing Educational Data? A regional center for processing educational data is a central physical plant--equipped with appropriate facilities and personnel--which conducts data-processing operations for the benefit of a number of school districts in one or more counties located in a convenient geographic area. This regional center is the core of a cooperative system that is typically the result of real needs of school districts (a) which may not be able to afford the purchase and operation of their own equipment; and/or (b) which subscribe to the proposition that a regional system is nearly always more practical and more efficient than a local one.

A regional system of this kind is a joint effort on the part of educators at the local and intermediate level to resolve the ever-growing problem of how to collect, process, and report pupil personnel data and other school information in such a way that intelligence reports on the status of education can be assured on the bases of reliability and efficiency. Several prototype centers have been operating in California for several years.

What Does the Regional Center Do? The regional center processes school data by means of efficient, high speed automation--in sharp contrast to the slow, tedious manual methods traditionally used by teachers, counselors, school administrators, and clerks. Areas of information for machine processing at the center include testing of various kinds, grade reporting, preparation of data for cumulative folders and permanent records, attendance accounting, student registration, and scheduling of student courses and classes. In addition to these, school district payroll operations can be run. While regional services now mainly involve pupil personnel services, an operational program will be in effect during 1965 for processing additional business information; and within a short period of time the program will be expanded to involve all business functions, instructional materials and equipment, and both classified and professional personnel.

Automated processing at a regional center can relate items of information from any sub-unit so that the data can be correlated for useful purposes--for example, between test scores and marks achieved in class. The development of a total information system in education will allow a great many things to be accomplished, including the first true cost analysis of each aspect of the various school programs.

Why Should Data-Processing Centers Be Operated on a Regional Basis? Data processing is a big business. It is also costly. While it is true that in the past few years the cost of automated equipment has gone down and, on the other hand, the power and sophistication of the equipment have increased, the fact remains that most school districts will never be able to attack the total problem of information without access to a computer. Key sort, punch card, and other piecemeal approaches will not solve the problem. Speeding up the handling of information that does not need to be handled at all is not the solution, either.

School districts, therefore, are increasingly faced with the choice of (a) developing an information system within their own boundaries (or adopting an existing system); or (b) taking the opportunity of participating in a regional EDP enterprise. Larger, more sophisticated equipment can process data on a lower per-unit cost than a multiplicity of smaller installations. It is projected that a single, sophisticated, well-staffed regional center can better serve the schools within a geographic area than a number if isolated centers in the same area, each serving one district.

What Happens to Local District Data-Processing Installations if Regional Centers Come into Being? School districts that are large enough to justify current installations of data-processing equipment can select their own future patterns. First, they may decide to continue using their equipment to do whatever things they can do best. In peak load periods they may choose to shunt certain overloads to the regional center for processing. They may also decide that they can better serve their schools by maintaining their district installations for the preparation of data for regional center processing. In this way, collection, correction, and coordination could be handled by district personnel while the ultimate processing would be handled at the regional level.

A second choice might be that the school district could dispense with most or all of its equipment but retain key personnel on its staff of data processors. The major role of the district staff would be that of coordinating district efforts with the regional center. The handling of forms and documents would be channeled through the data-processing staff, and the district's inservice orientation and coordination would also be staff functions. The actual machine processing of all data would be accomplished at the regional center.

Who Cooperates in the Regional Center? The region served by the center would include school districts and offices of county superintendents of schools. Participants in the regional system would be those who would wish to utilize the center's services. Since the center would be run and managed by its customers, the system would be truly a cooperative endeavor. Areas of cooperation would include the development of information systems; the types, qualities, and volumes of data to be processed; input and output forms; and all other essential aspects of operations at the center.

What Is the Role of the State Department of Education? California and the federal government are currently cooperating in the development of an efficient system for processing school data. The Research and Development Center in Educational Data Processing, with headquarters in Sacramento, is acting as the developmental arm of this joint effort between the State Department of Education and the U. S. Office of Education. At the present time, the Sacramento Regional Data Processing Center is cooperating in this experiment in that it serves as a field-test "arm" in the system that is being developed.

The role of the State Department of Education, then, would be considered as twofold: that of development and coordination. The Department is assuming leadership in the development of educational intelligence systems. It is developing the systems from the standpoint of the school district rather than from the departmental level. The Research and Development Center has worked with more than 100 educators throughout the state in developing current pupil personnel applications and plans to expand its work through the various associations and field workers to include business, curriculum, personnel, and all other essential areas. The ultimate goal is the development of a total system for processing educational data.

What Is the Cost of Operating a Regional Center? Several studies made in the past few years indicate that the yearly per-pupil cost for processing student information at the secondary level ranges from $2.50 to $3.00. Much depends on the type of equipment, the competency of the staff, and other related factors, including the volume of data being processed. The cost at the elementary level might range from $1.75 to $2.25 per pupil. On the basis of experience derived from the three-year pilot study in the Richmond Unified School District, it is anticipated that all data-processing applications, including all the elements in a total system, could be handled at a per-pupil cost of approximately $3.00. This is assuming that the regional center serves a minimum of 100,000 students. A simple projection would show that 100,000 multiplied by $3.00 would total $300,000. A maximum enrollment probably would be in the neighborhood of 300,000 students.

When Do the Regional Centers Begin Operations? The first regional centers that will be working in conjunction with the Research and Development Center will begin operations in July of 1965. The Sacramento Regional Center will serve 15 counties in northern California; the Ventura Regional Center will serve three counties in southern California. Because considerable interest has been shown in the regional center concept, it is anticipated that in 1966 three additional centers will be phased in. It is hoped that by 1970 there will be at least 12 regional centers operating in the state. The twofold key to success in these regional ventures is thorough planning and in-depth orientation of the participants.

Where Should the Equipment Be Located? Location of regional data-processing equipment is actually of little concern. This point must be emphasized because many feel that possession and/or location of the hardware is of prime consideration for successful information processing. This is not true. Today--and this would be even more applicable tomorrow--the fixed location of the processing equipment need not be a prime factor in the development of an educational processing system. Educators must be concerned with access to technological facilities but do not need to have the equipment located in any designated spot.

The really important factor is that the educator must devote his time and effort to the development of an efficient information system. Any technological problem in implementing this system should be left to the technical staff. If a computer is needed, then one must be made available. The location of this computer or any other piece of hardware may be as near or as far as practical consideration dictates.

Within the foreseeable future, computer techniques and facilities that will provide even the smallest school district with access to needed machines are expected to be developed. Computing centers in Massachusetts are already processing data from sources halfway around the world. In southern California data are stored and retrieved on machines for the benefit of users thousands of miles away. These systems are classified as "real-time" or "on-line" systems. A more understandable term is "immediate information system."

Why Not Use County Government or Commercial Equipment? Data-processing equipment may have tremendous capacity and power. Communication devices allow the flexibility needed to gather data from many sources. However, the development of an operational system, at this point in time, is dependent more upon people than upon equipment. While systems development is going on in many areas, it takes time to develop the systems. In a number of instances the equipment has been ordered before the system has been developed.

The technicians and managers who operate non-educational data centers, therefore, must be concerned with keeping themselves and their equipment busy. Schools present a ready source of volume and revenue because there are certain applications that are straightforward and relatively simple to convert to automated processes. However, as the time draws near for payroll processing or highway calculations or any other activities which may be construed as taking priority over education, then report cards, test scores, and other kinds of material for educational processing are shelved until sufficient time is available to complete the job.

Several months ago the California Educational Data Processing Association, in a letter circulated to all superintendents of schools in California, cautioned against the use of service bureaus or other agencies that look upon educational data processing as a likely source of revenue. It also cautioned that any service bureau that is processing data for schools could cause the entire educational program to be hamstrung if the data are not processed and the products not delivered (a) in useful form; and (b) on time.

Non-educational processing bureaus may belong to municipal or county governments, or they may be commercial agencies. Experience has already shown, importantly, that educators must protect themselves and that one way of doing this is to establish educational data-processing centers. It has been found, further, that the most efficient, most effective, and least expensive means of providing the schools with the technological data-processing services they need is through cooperative regional systems.

Who Is in Charge of Regional Centers? In every case the answer to this question must be that the user determines how a certain operation will take place. It is anticipated that in each center there will be formed an advisory committee (or "steering committee") composed composed of representatives from the various school districts being served. The advisory committee would function along the lines described elsewhere in this report.

Administratively, of course, certain key personnel supervise the operations of the regional center. But these persons do not "run" the system in the sense of telling the schools what to do. The cardinal purpose of the center is always that of serving education.

How Are Data Collected and Transmitted to the Center? It is possible to collect data on documents of the size with which most educators are familiar. The $8\frac{1}{2}$ X 11-inch document, for example, is the same size as that of typical test-answer sheets, attendance accounting forms, and most of the other documents that educators encounter during their workday. By using special formats on these documents, much of the information that is now laboriously transcribed by hand or typed onto other documents can be collected by means of the specially designed format.

To illustrate: the teacher's roll sheet for a given class can provide for student identification by his printed name, spaces for the various marks that the teacher might give for student progress and achievement, and a section for attendance accounting. The teacher can mark the absence or presence of a student for a two or four-week period and, at the same time, record a two or four-week mark for achievement. Documents of this type would be collected from the teachers at the end of the attendance period and turned into the central office on a Friday afternoon. Over the weekend the data center would prepare a new worksheet with the student's name, the attendance data summarized, the mark entered in a special column, and adequate room provided for the next marking period and the next attendance period. This information could be accumulated during the semester so that at any given time the teachers would know at a glance the status of their students regarding attendance and achievement.

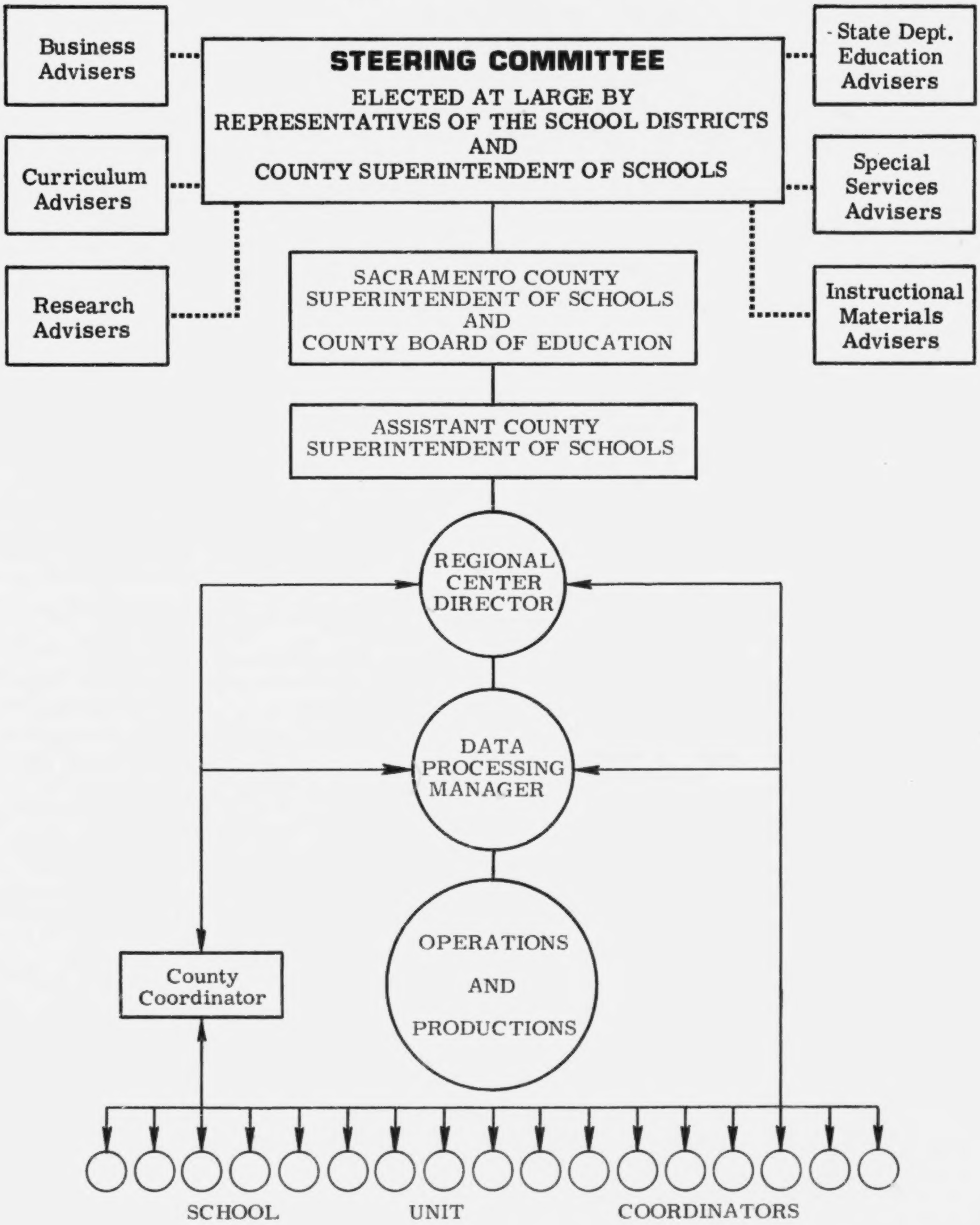
A method such as the one just described would require considerably less time at the end of the semester for the summarization and compilation of data for the semester report cards. Transmission of data from these documents would be simplified by the use of data-transmission devices such as the dataphone and other existing wire communications. All of this is possible now. The problem is not with technology but, rather, with making people aware of the technological possibilities that exist.

ORGANIZATIONAL FLOW CHARTS

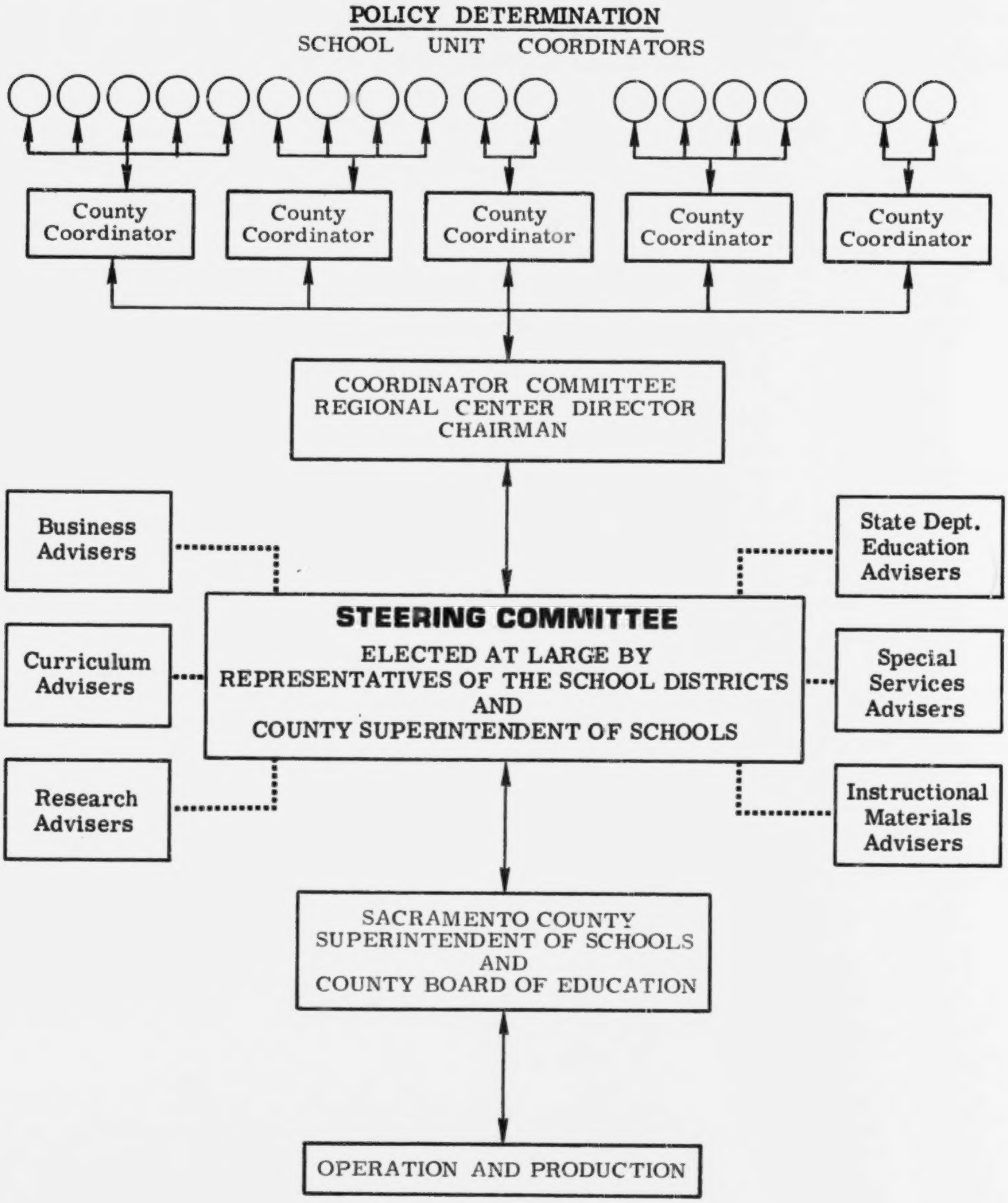
The two charts on the pages that follow have been designed to illustrate, by graphic means, how regional educational data-processing systems would be organized for efficient operation. These have to do with personnel, not material. The finest equipment and the best housing would be worth nothing without good staffing; and it goes without saying that a regional staff would not progress far, if anywhere at all, without well-planned pre-operational organization according to the abilities and roles of the personnel involved.

It is to be noted that particular attention is paid to the placement and functions of the steering committee--the "policy determination" advisory group--and its relationships to the other components of the system.

Operational Organization


Business Advisers
Curriculum Advisers
Research Advisers
STEERING COMMITTEE
ELECTED AT LARGE BY REPRESENTATIVES OF THE SCHOOL DISTRICTS AND COUNTY SUPERINTENDENT OF SCHOOLS
State Dept. Education Advisers
Special Services Advisers
Instructional Materials Advisers
SACRAMENTO COUNTY SUPERINTENDENT OF SCHOOLS AND COUNTY BOARD OF EDUCATION
ASSISTANT COUNTY SUPERINTENDENT OF SCHOOLS
REGIONAL CENTER DIRECTOR
DATA PROCESSING MANAGER
OPERATIONS AND PRODUCTIONS
County Coordinator
SCHOOL UNIT COORDINATORS

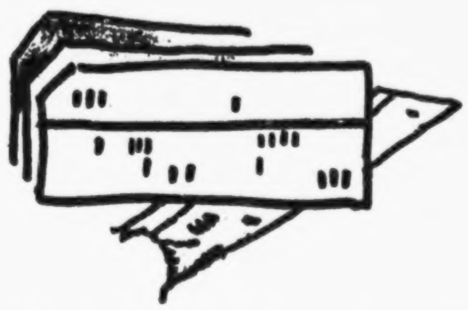
Organization for Regional Educational Data Processing Services


POLICY DETERMINATION
SCHOOL UNIT COORDINATORS
County Coordinator
County Coordinator
County Coordinator
County Coordinator
County Coordinator
COORDINATOR COMMITTEE REGIONAL CENTER DIRECTOR CHAIRMAN
Business Advisers
Curriculum Advisers
Research Advisers
STEERING COMMITTEE
ELECTED AT LARGE BY REPRESENTATIVES OF THE SCHOOL DISTRICTS AND COUNTY SUPERINTENDENT OF SCHOOLS
State Dept. Education Advisers
Special Services Advisers
Instructional Materials Advisers
SACRAMENTO COUNTY SUPERINTENDENT OF SCHOOLS AND COUNTY BOARD OF EDUCATION
OPERATION AND PRODUCTION

Appendix E

CURRICULUM COMPATIBILITY, CODING AND COMPUTERS[1]

Soaring enrollments and emphasis on new broad-scale programs has resulted in increased demands for information about the curriculum. Apart from the divergence of course offerings based on the various philosophical approaches to education is the problem of determining—in spite of any title used—what courses actually are offered in a given school or district. This manifests itself most dramatically in transcript interpretation and evaluation, but also is evident in any attempts to compile reports of a regional or state-wide nature. The magnitude of the problem continues to grow, and must be resolved before other aspects of the educational picture can be placed in perspective. Long recognized as a pioneer in educational innovation, California already has initiated a plan to provide a solution to the problem.



THE California Curriculum Compatibility and Course Coding Committee was formed in August, 1964 to plan, develop and implement a state-wide system for describing courses offered in secondary schools. This action was taken as a result of several years of preliminary study by the State Department of Education. The study revealed that a state-wide system for improving the communication of information about the curriculum was feasible, and that many educators would support the system.

While the full committee is composed of over 75 superintendents and principals, the foundation work has been entrusted to a Steering Committee. The Steering Committee first met in September, 1964 and has been working on the planning and development aspects of the system. Some of the observations of the committee are:

A. Communicating curricular information involves both the development of a system for handling course descriptions and coding information, and implementing the system for machine processing, if such is to be used.

B. The chief purpose of the course description and coding system is to enable curricular information to be communicated among schools and colleges quickly and easily, with uniform meaning and without being confused by variations in course titles.

C. Course descriptions must be complete and unique. Definitions

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[1] *Reprint of Robert L. Howe, "Curriculum Compatibility, Coding and Computers,"* Journal of Secondary Education, *XLI (January, 1966), 38-42.*

should be as complete as needed but not unwieldy.

D. Educational Testing Service has developed a curriculum coding method (CPGA) that is in use in several states. Also, several other states have developed their own curriculum coding procedures. Some of these are little more than an arbitrary assigning of numbers to an alphabetical list of courses, while others border on a systems approach. The California group is working cooperatively with the U.S. Office of Education in their current development of a handbook on the instructional program which may someday provide the foundation for a nationwide course description and coding system.

E. Educators should concentrate on the description of courses. The specifics of developing a code for curriculum descriptions will best be left to those who are experienced in the coding field.

F. Titles at the local district level will not be standardized, but the course description and code will provide an easy key to the many and varied titles attached to equivalent courses.

G. The development of a course description catalog should facilitate interpretation at the local district level, as well as at the county and state level.

H. The effect such a curriculum description and coding system will have on existing reporting procedures will be determined by time. However, any method that improves the communication of information should lead ultimately to easier and less frequent reporting and to a better understanding of the structure of education. This could result in the passage of more supportive legislation.

I. Many agencies working with information from schools are interested in cooperating in the use of a uniform course description and coding system. Private schools and institutions of higher learning also have indicated their support of this project.

J. Widespread adoption of such a system will not only facilitate the exchange of transcripts and cumulative records, but also will simplify and reduce the number of reports.

FIVE Steering Committee and many subcommittee meetings resulted in a First Draft of the Course Catalog. Issued in August, the 330-page catalog is being revised for a re-issuance in 1966.

Even though the proposed system is designed specifically for secondary schools, it is conceivable that the 7-12 grade level range can be extended to include elementary and adult schools ,and junior colleges. Copies of the catalog are not yet available for general distribution, but questions or comments about the committee or its work are welcomed.

Each member of the Steering Committee worked on a specific area of the curriculum, and the staff specialists of his own district, as well as from surrounding districts, were involved in the project. All course descriptions developed by these groups have been incorporated in the catalog.

The descriptions have been designed to reflect as accurately as possible the current status of the curriculum in the field. They have not been presented as the latest or the most desirable curriculum format.

When the Course Catalog is released for distribution and review by the full committee, all special subject area organizations also will be encouraged to submit in writing alternative proposals for handling their particular subject matter content. The Steering Committee maintains its prerogative of accepting or rejecting any or all suggestions and recommendations.

Although changes were made in the catalog and code format at the September, 1965 Steering Committee meeting, the general flavor of the code can be drawn from the following material.

The proposed coding system is based upon a six-character code. (A character may be an alphabetic, numeric or special symbol.)

First Character: An alphabetic character which groups curricular offerings into areas or departments. These are:

Code	*Subject Matter Area*
A	Agriculture
B	Art
C	Business education
D	Business education
E	English
F	English
G	Foreign languages
H	Foreign languages
I	Not used
J	Homemaking education
K	Industrial arts
L	Industrial arts
M	Mathematics
N	Music
O	Not used
P	Physical education
Q	Science, life
R	Science, physical
S	Science, social, and History
T	Trade and Technical
U	Trade and technical
V	Reserved for possible use by adult schools and higher education
W	
X	
Y	Non-departmental (independent) courses
Z	Not used

Second character: A numeric character, used to subdivide departmental offerings into various specialties. Digit 0 (zero) is reserved for general offerings.

Third character: A numeric character, used to specify the lowest permitted grade level (school year) or, if upgraded, the grade level at which a course most commonly is offered. For present purposes, the following will be used:

7—Seventh grade
8—Eighth grade
9—Ninth grade
0—Tenth grade
1—Eleventh grade
2—Twelfth grade

Fourth character: Used for two purposes. Digits 0, 1, 2, 3, and 4 indicate a first semester course; digits 5, 6, 7, 8 and 9 a second semester course. Also, digits 0 and 5 are used only to specify a course required to be completed by all pupils. The remaining digits are available for any other courses. Year courses (two semesters) are identified by semester in order to provide positive identification of summer school continuous offering and other non-standard progressions. The *title* of a year course is recorded as "(Course Title)

1-2," or, for some continuing courses, "(Course Title) 3-4," etc.

Fifth character: Used to designate the level or grouping of the course, or the lowest group permitted in the course.

0—Non-grouped (Heterogeneous)
1—MGM (mentally gifted minor—Ed. Code defined)
2—X or highest level of regular grouping
3—Y or average group
4—Z or slow group
5—Remedial group (Fundamental or Educationally handicapped)
6—EMR (Educable mentally retarded—Ed. Code defined)
7—Physically handicapped
8—Not used at present
9—Not used at present

Sixth character: This digit is used to identify the unit value of the course, and will become more important as flexible and non-traditional types of programs are developed.

Adult high school courses which are equivalent to day high school courses are suggested for inclusion in this system; vacant spaces have been left in the coding system for adult high school courses which do not ordinarily have a counterpart in the day high schools, so that these may be included at a later time. Junior colleges appear to have problems peculiar to their situation, and it has not yet been determined if the proposed format can successfully be applied to their offerings. Studies of such articulation will continue.

Any individual school or school district attempting to use the catalog will undoubtedly encounter difficulties. Questions will arise as to the most appropriate code for certain courses. Variations in content or description may sometimes appear to be so material as to invalidate the identity of certain courses. There will always be such differences, and it is considered neither necessary nor desirable that course content of "equivalent" courses be identical from school to school. As long as a course is basically and essentially the same as another course, however, a code number should be just as meaningful as a title, and certainly more convenient.

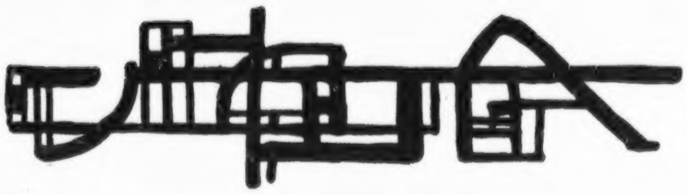
Neither should schools be concerned that they will be forced to make use of this system. It will be any school's prerogative to continue the descriptive title system now in use. However, studies are currently being made by the California State Department of Education to determine if it will be feasible to report curricular information, such as for the October Report, by code only. It is possible that in the future such a procedure may be specified for State reports.

PRIOR to release of the catalog to the field, a series of orientation meetings will be scheduled. Instructions for use of the system will be complete and definitive.

Studies similar to this are currently being undertaken in other states. Eventually, a single coding system may be used nationwide to communicate curricular intelligence between schools and colleges. Such a code will permit computer-type operations that will provide a more rapid and efficient handling of information about the curriculum. Logical extension of the coding system to instructional materials, teacher certification, and all areas relating to the instructional setting will result in a more smoothly operating educational program.

Pilot use of the system will begin this year in several districts and in the Sacramento Regional Educational Data Processing Center. Experience derived from these trials will be used as the basis for modification and refinement of the system. While it is not anticipated that this course description and coding effort will solve all of education's problems, it is believed that it is a vital first step in the right direction.

If implementation proceeds as planned, many teachers, counselors and administrators soon will find their jobs less complicated by clerical tasks, thanks to curriculum compatibility—and coding and computers.



Appendix F

CALIFORNIA CONFERENCE ON EDUCATIONAL DATA PROCESSING JUNE 1965[1]

The California Educational Information Systems Conference was called at the behest of many individuals and groups in the interest of a concerted national effort in educational data processing.

The host group, the R/D staff in EDP of the California State Department of Education, thanks all the participants for their efforts and especially the Honeywell Corporation for their financial support which made the sessions possible; also the Florida State Department of Education for supplemental funding.

The following individuals participated in the conference:

Gil Boyer
NEEDS Project
Harvard University
Cambridge, Mass.

Don Bushnell
Brooks Foundation
Santa Barbara, Calif.

John Caffrey
System Development Corp.
Santa Monica, Calif.

Alvin Grossman
State Department
of Education
Sacramento, Calif.

Robert L. Howe
State Department
of Education
Sacramento, Calif.

John Loughary
University of Oregon
Eugene, Ore.

Robert Marker
Iowa Information Center
University of Iowa
Iowa City, Iowa

Murray Pfefferman
U.S. Office of Education
Washington, D.C.

Robert Sims
State Department
of Education
Tallahassee, Fla.

Murray Tondow
Palo Alto School
District
Palo Alto, Calif.

Joe Turner
Chicago Public
Schools
Chicago, Ill.

It is hoped that this "white paper" can serve as a basis for further discussion leading to a concrete proposal for a true national system.

ALVIN GROSSMAN
ROBERT L. HOWE

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[1] *Reprint of* California Conference on Educational Data Processing, *June, 1965. A publication of the Research and Development Center in Educational Data Processing. Sacramento: California State Department of Education, 1965.*

THE DESIGN OF A NATIONAL INFORMATION NETWORK THROUGH THE DEVELOPMENT OF TIME-SHARING SYSTEMS

During the Sausalito Conference on Educational Information Systems a great deal of confusion existed as to the meaning and definitions of modern computing and its demands for education. It was strongly insisted that personnel involved in educational data processing should not go back to tape-oriented systems and fragmented programs but, rather, should try to concentrate on mass-storage needs and a simplified user-oriented language which can be easily taught to people. It was emphasized by many of the conferees that (1) concentration of effort should not be on the specialist's area of techniques of programming, or on how to get manpower, or on how to do research, but on making information available; and (2) once the information becomes available, it would become much easier to work with the persons to whom the information is accessible--to teach them how to use it properly. In this paper an attempt is made to clarify the various terms that were discussed in the conference and to suggest definitions pertaining to the kinds of "fast-response systems" that were described.

It appears that fast-response systems are being developed over a broad front--so broad, in fact, that it would be impractical to review them in one report. The following list indicates some of the major characteristics of fast-response systems; some possible values are shown for each characteristic. Systems are being developed from many of the different combinations of these values.

Characteristics of Fast-Response Systems

- Speed of response: less than one second; one to several seconds; many seconds to one or more minutes.
- Direction of the computing: program-directed, user-directed.
- Areas of application: calculations (general routines vs. procedures); file processing, inquiry and response; program development and debugging, simulation and games.
- Goal is improved performance: reduce program debugging turn-around time; favor completion of small problems at the expense of larger problems; faster processing of transactions; faster preparation of management reports.
- Use of time: micro-time slices; macro-time slices; compute-to-completion.
- Ability to defer operations: vital operation, cannot defer any operations; heavily loaded, thus limiting amount of allowable down time; lightly loaded, thus inconvenient if system down.
- Recovery from error: extremely complex, operator must determine status of all programs and reset; user controls the recovery.
- Job environment: many small jobs; many small jobs and a few large jobs; all large jobs.

- User environment: individual users, independent of other users; some users in groups, others individual; combination of human and other computers as users.

Three Main Categories

Within this broad spectrum of fast-response systems, however, there are three main categories that seem to be receiving the bulk of attention today. They are as follows:

- Time-shared systems which operate on many problems simultaneously through the use of "time slices"; these systems are used today primarily for algebraic-type calculations and program debugging.
- Real-time systems used for maintaining files of business-type data in real time; in general, these systems are becoming much more complex than time-shared systems because of the need for systems integration, because the system is vital and must keep running, because the system also must use multi-programming techniques due to the long delays in accessing random-access memories.
- Management information systems, which are aimed at retrieving information from files and presenting it in report format, sometimes by the use of output display consoles.

For business applications, the real-time systems have so far received the most attention among the fast-response systems. The airline reservations systems, on-line savings bank systems, Lockheed's real-time production control systems--these are the systems that have been most discussed. Management information systems are beginning to receive attention, too. But so far, very little attention has been given to the educational uses of time-shared systems. Perhaps this is because time-shared systems are still in a development stage, and thus far they have been developed primarily for engineering and scientific uses.

For our purposes we will try to define time-sharing as the simultaneous use of a single computing system by more than one user, each of whom acts vis-a-vis to the computer as though he were the exclusive user.

Within this definition are included as wide a variety of situations as those ranging from Project MAC to an airline reservation system. Also within this concept is envisioned the computer-based national educational information network of the future.

Significant Elements of Time-Sharing

To come to grips with the concept of time-sharing, it must be differentiated into more meaningful elements. Six of these are discussed at some length in the sections that follow. It must be appreciated, of course, that the concept of real time is common to all time-sharing applications.

Real Time--a Common Element. Real time involves a computer response to a user action and a time context appropriate to the needs of the user. Every time-sharing application must be operated on a real-time basis that is the fundamental precept to be served by time-sharing. In most instances, the computer response time will be measured in milliseconds or seconds although there may be some applications where the response time requirements will be less stringent. To the user who activates the computer through an electro-mechanical device (such as a teletype keyboard), response time will be characterized as almost instantaneous.

User Software. A very elaborate construction of software routines is necessary to permit a computing system to operate on a time-sharing basis, and much of the current effort across the country is being spent in this area of developing control and executive programs. To the user, the perspective is considerably different. The user is only aware of the extent to which he is permitted to create and originate programs for his own computing. It is hoped that in some time-sharing situations, the user will have available one or more assembler or compiler languages and have a capability and flexibility to program for any situation which would be available to a program operating on the same system without the time-sharing mode. The user will be able to operate his own programs without regard to the programs being operated by other users. In other situations, the user will be limited to a single specialized problem-oriented language but will have an ability to utilize this to its fullest capability. These programs will be operated on a compile-and-go basis and will be independent of programs operated by the other users. There will also be situations where the user will have no programming available to him; the software for his needs will be made availabe and will be fixed. These three situations represent the salient areas; actual situations may be a shading of these positions.

Capability and Location of Remote Consoles. As each of the several users of a time-sharing system acts as though he were the exclusive user, each must have a console exclusively available. These consoles are remote in the sense they are not the main control console of the system. Extent of the remoteness and actual distance is a function of limitations of data communications. These limitations are governed generally by economics rather than by physical requirements. Therefore, the remote consoles of the users may be all located within a single room or distributed throughout a continent.

The capability of the remote console is of greater importance. The console must be capable of duplex operations; otherwise there is no real-time relationship. The extent of the data that will be required to be transmitted from the user to the computing system will vary from brief stylized messages, captured and transmitted by a special purpose device, to data that are originated by the user on a teletype keyboard. In addition, there may be a requirement to transmit data which have been stored on punchcards or magnetic tape, or which originate through optical scanners.

Response from the computer to the user will vary from the activation of signal lights on special-purpose consoles to the requirements for page printers, paper tape perforators, card punchers, or video displays. The capability of the remote console will be a function of the user's needs.

The Basis for Access to the Computer. Another fundamental element involves the method of determining access to the computer by the several users. There appear to be two principles at present: commutation and queueing. In the former case, each ready user is allotted a measured equal portion of time on a computing system. During this postion of time, which will probably be measured in milliseconds, as much computing as can be accomplished is performed. Then the user's work is "put aside," and the work of the next user is processed. To complete the computations a user will probably require many turns.

In the latter case, the principle of priority is established, such as "first in," "first out." The processing for the first user is completed either in its entirety or through some designated point before the processing for the second user is commenced. A queueing program is designed to regulate the admittance of the various users to the computer processer. This program, while based on a principle such as "first in," "first out," may also recognize emergency requirements for access to the computer and respond accordingly.

Under either system, there will be the need to poll the various users' consoles on a regular basis to determine whether the user is active or dormant at the time of polling. It's only when a user becomes active that the time-sharing executive routine takes control and regulates time-sharing on a commutator or on a queueing basis.

The Availability of Data in Time-Shared Files. The information available within the computing system to a time-sharing user will also vary greatly depending on the need. File data can be active or dormant, restricted or unrestricted.

Active files are those undergoing continual updating as a result of the data introduced during the time-sharing use; dormant files are those for information only. Restricted files are those available to a single user or a group of users, while unrestricted files are available to all users in a time-sharing system. Therefore, an active, unrestricted file would contain data which are continually being updated by the users of that system and are available to all users, while a dormant unrestricted file would contain data that can only be accessed by all users for information purposes only. Other combinations will also be encountered.

Many of the predictions for a future national educational information system could envision the extensive use of dormant and active, unrestricted files of data which would represent major investments, perhaps by the U. S. Office of Education or by private foundations and which could become available to a large number of users through time sharing. The development of communication networks linking time-sharing systems (now under development), each with their peculiar unrestricted files, will greatly amplify the number of users having access to these files.

Investment Basis for the Implementation of Time-Sharing Systems. The final element in the analysis of time-sharing concepts is the investment basis for the implementation of the system. Time-sharing exists today in three forms: in a research/development stage, in privately owned commercial systems, and as private service bureaus for hire. Much of the development for time-sharing hardware and software requirements has been through government-sponsored research. Future development will be limited primarily to the latter two cases: privately owned time-sharing systems or service bureaus. The development of a national information system might be accomplished by a group of educators in the various states pooling their resources and funding so that a unified developmental front could take place.

Service to the User

The conference group felt that the major emphasis in any type of time-shared system should be placed upon service to the user. Service is considered to be more important than the highly efficient use of the computer. Expressed another way, faster service to the individual user is achieved at the expense of greater computer running time and memory time that might be needed to do the same jobs on a batch basis.

Major Goals of a Time-Shared System

As cited by the group, the major goals fo a time-shared system are listed as follows:

- Faster turn-around of debugging test.
- The improvement of communications between the user and the computer by use of powerful software packages--for example, Jovial, at SDC; the Dartmouth package; and Joss, a system developed at the Rand Corporation which uses a user-oriented language, where algebraic expressions are typed in much the same format that we have been accustomed to writing them. Such improved communications cut down the "get-ready" time necessary in conventional computer usage.
- The ability to edit the input for errors as it is entered, and immediately to notify the user of errors. This means that time-shared systems largely eliminate the recompilations and calculations that are prevalent in batch-type systems. Further, by well-planned diagnostic procedures, a system should have the ability to help a novice user extract himself from an error and continue with his job.
- To aid the user in trial-and-error problem solving. In problem solving, the user is constantly exercising his judgment as he sees the results of the computations. He sets up his problem, starts computing through the use of his interface package, and then looks at the results. If what he sees doesn't look right, he presses the interrupt key, thus stopping the compiler. He changes the program and tries again. In this way, the problem's solution is directed by the user as he feels his way toward it. In solving the problem in such a manner, the user is learning more about the problem, and is better able to solve similar problems in the future.
- The further utilization of the computer by using "background" jobs. These are usually production-type jobs. In a time-shared system they are the lowest in priority, and are worked on as time is available so as to keep

the computer always busy. Actually, these background jobs are considered a subset of regular time-sharing jobs; they are simply the ones wherein a user decides he does not want to wait around for the results.

There was general agreement that the future role of educational data processing would center around the time-sharing concept. However, there was neither time for discussion nor specific agreement on the strategy that should be chosen in developing a national effort to implement this concept. It was left to the hosts of the conference to develop and submit a plan for review. The following, then, is an attempt to design the next steps to be taken.

Planning for National Development

The design of a developmental plan for a project as important and pervasive in its potential effect on education as this one is a task which deserves much care. It will involve many of the forward-looking states in the development and organization of a master plan. A major objective of the plan, perhaps the most significant, is to preserve and promote the drive toward EDP by the more advanced states and offer coordination and guidance to any or all states only as far as is necessary for each state to reach a desired goal of an integrated statewide information system.

The developmental plan of a national information system may cover a ten year period. The initial development plan for a long-term project must identify and develop two basic elements:

- Broad strategy for reaching a goal
- Insight into the necessary steps of implementation

With respect to the second item, it is recognized that major emphasis must be placed on the early phases of the plan. This provides the necessary insight and understanding to advance the project to its next phase, and also illuminates the immediate course of action.

The detailed structure of individual steps in the development must be sufficiently flexible to allow modification as the project develops. In view of this requirement, the initial steps of implementation must be designed to provide, within the constraints of the basic strategy, as broad an applicability as possible.

Strategy of Implementation

The implementation strategy for a national educational system should be developed in the context of the following major considerations:

- Interaction between the information system proper and the organizational EDP implementation in the various states.
- Relative phasing of the participation of the U. S. Office of Education, local districts, and state departments of education in the total network.

- Desirability of an early, small-scale demonstration of the capabilities of the system by a suitable "pilot" program, which would also identify potential problems during an early phase of the project.

The Pilot Program

A valued concept in the development of a large project involving a sizeable expenditure of funds is the "pilot" operation. The "pilot" is a smaller-scale version of the total program which can be implemented on a shorter time scale (often in parallel with the design of the larger program) and which can be used to test and verify the precepts and concepts (technical, economic, and operational) of the overall project. The pilot program often results in modifications of the total program based on experiences derived from the pilot operation.

Examination of the applicability of the pilot concept to the National Information System leads to the conclusion that this concept is generally applicable and would give tangible demonstration at an early phase of the total development plant, with concurrent proof of technical and operational feasibility as well as design to feed back into the main program.

As envisioned, the pilot program would be built around a particular subfunction. For example, this could be the establishment and upkeep of a family-oriented file for a small segment of population such as a school district. The need for such a file--to assemble a complete history of the family interaction (school district, with other school districts throughout the state as well as possible contacts with other state and federal offices)--has often been expressed by educators.

The general characteristics of the subsystem selected as a pilot program would be as follows:

- The application should be a good candidate for EDP, with potential subsequent benefits.
- The application should require some inputs from other organizations in order to demonstrate multi-organization tie-in. These inputs should preferably be available in machine format.
- School district tie-in is desirable to demonstrate vertical interschool communications.
- The application should be significant as a demonstration, yet be small enough to be accomplished in two or three years.
- Funding for the conversion of the application to EDP (at least on a small demonstration basis) must be available.

Information System Management

The implementation of a National Information System would be an activity potentially involved in the expenditure of sizeable sums and a high degree of interaction with many organizations of state and federal governments. Success of the program would be strongly determined by the substance and staffing of its management organization. It is recommended that, following the example of the aerospace industries, the management technique of the program office be utilized to implement the nationwide information system.

Interest on the part of many states in integrated information systems is already high and is increasing rapidly. Certainly the federal government would have strong motivation to encourage the development of such systems. The success in attracting potential federal funding will be strongly increased by the identification of a senior official representing this National Information System. It would be only natural that this individual be the director of the program office.

The program office should be charged with complete responsibility for the implementation of the National Information System. As envisioned, the program office would consist of a program director and a small, tightly knit staff of senior personnel. The group would manage the program and operate through other state and federal personnel, contractors, and consultants. Because of the size of the program, the program office would likely employ the services of a prime contractor.

The major functions of the program office should be as follows:

- Program control, including schedules and budget
- Technical direction
- Coordination and negotiation with other governmental jurisdiction--local, federal, and state
- Contracting

The program office would also be the nucleus of the operation organization, assisting and guiding when the developmental effort translates into an operating phase.

Information System Policy

A national group should be brought together at the earliest possible date to formulate, on a continuing basis, the broad management and administrative policies needed to guide development of the total program. This phase should begin with an initial study to produce a basic policy document within the first six months. The document should enunciate policy on the following subjects:

- Capital equipment will establish lease-or-buy policy for computers and communication equipment as well as facilities.
- Organizational EDP review will determine the policy under which existing organizational EDP will tie into the national network.

- State department of education relations are concerned with relationships of the system. In particular, the document should consider the conditions under which state departments may be assisted in their EDP efforts by means of grants, loans, or technical assistance.
- Information access will establish the access policy for information on the part of the public schools and the various elements in the private sector.
- Personnel will establish appropriate personnel acquisition rates, recommend a wage structure policy, and formulate a training policy.
- Financing will determine policy with respect to methods of financing the capital requirements of the National Information System.
- Developmental contracting will develop the policy governing the work areas for the various personnel assigned to the project and contractor personnel, and the types of contractual arrangements to be used during the various phases of the program.
- Activation priority will state priority policy for organizational (state and local) tie-in to the network.
- Operation will develop policy for operation of the various parts of the National Information System. Consideration should be given to conditions under which the system will lease a total service, grant or franchise, or operate purchased or leased equipment with operating personnel.

Information-system policy should be a continuing function during the entire life of the program. After publication of the initial policy document, it should be concerned with administration of the policy as well as updating of the policy document as required.

Capability and Interface Study

The objective of a capability and interface study would be to define the significant parameters that determine compatibility at the interface between the emerging national system and the EDP equipment of the various organizations which would be participating in the information system. A further objective would establish standards (1) for use by organizations that have not yet begun EDP activities; or (2) for more sufficient use of the system. The study should involve the following work elements:

- Study the requirements associated with the interconnection of different organizational EDP systems, including hardware and software. Develop criteria applicable to both hardware and software to enable compatible operation with the information system.
- Review existing and planned hardware and software of the various states that will participate and selected local school district organizations so as to determine use, capability, limitations, and interfaces with the total national effort.

- Develop an interface manual containing hardware and software compatibility criteria essential to interconnection with the National Information System and standards to be recommended to organizations instituting or planning EDP facilities.

This study should yield compatibility policy statements at the end of a six-month effort and, hopefully, an interface manual at the end of one year.

Organizational Activation Plan Development

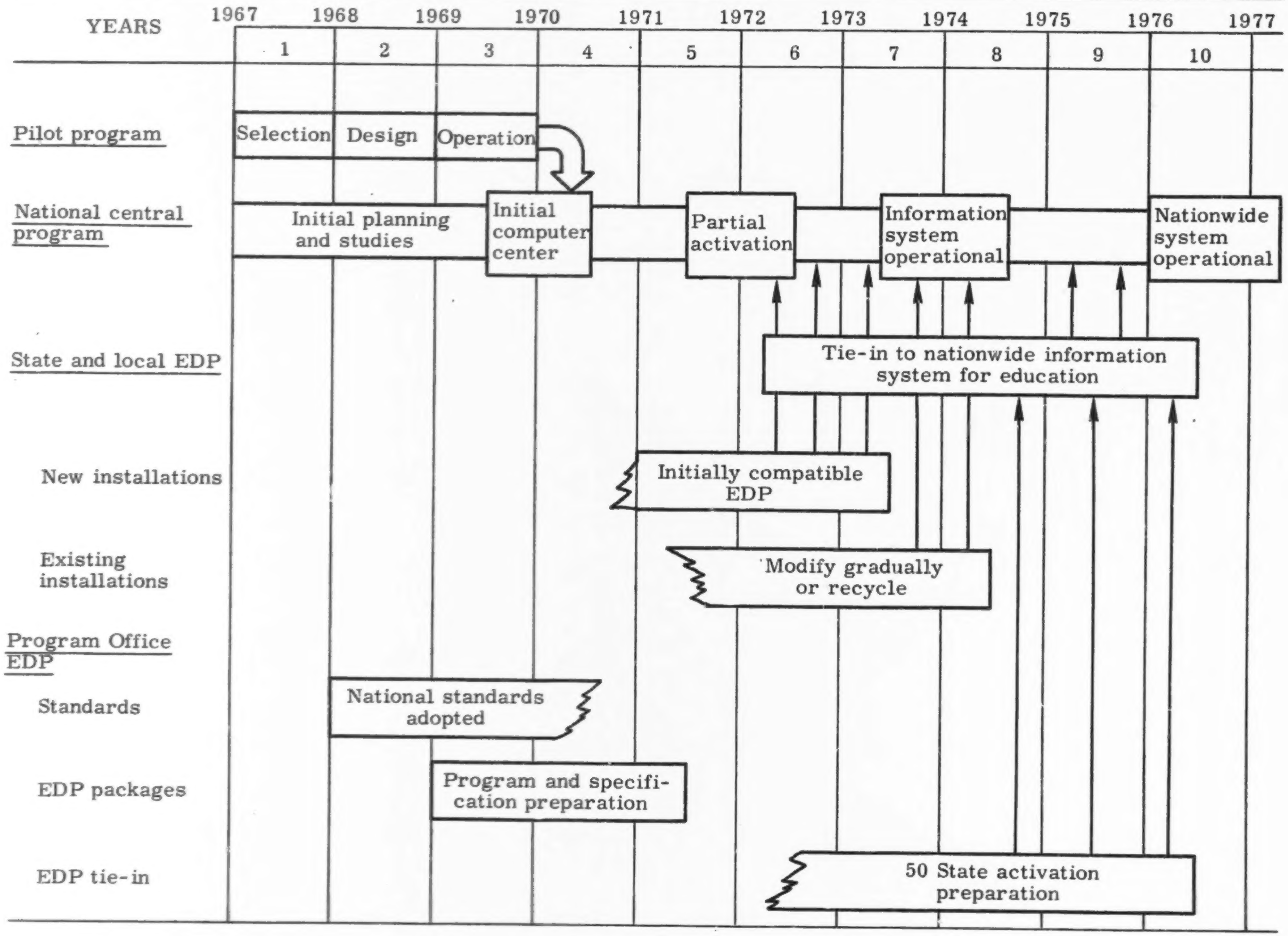
The objective in developing an "organizational activation plan" would be to establish a comprehensive organizational activation blueprint defining methods of scheduling and controlling the planning, design, development, testing, and activation of the information system in consonance with the organizational EDP systems; activation and subsequent integration into the National Information System. The plan could serve as a basic management tool for timely identification and correction of schedule inconsistencies and incompatibilities during the development and activation of organizational EDP systems. Work required encompasses the following items:

- Study the nature of existing state organization EDP systems in conjunction with local school district systems and make plans with regard to developing the National Information System requirements.
- Develop a preliminary master tie-in schedule of organizational EDP systems, considering the status of oranizational development; the desirability of functional--or regional--common EDP systems; and a possibility of early culmination of some data files on a regional or functional basis.
- Make a preliminary identification of organizational data systems tie-ins which would yield an early operational national system.
- Make a preliminary identification of data needed for management planning and for a management reporting and control system.
- Develop a control and scheduling model based on the pertinent parameters.
- Develop detailed critical path scheduling network for the information system.
- Develop a training plan, including levels of training, to prepare personnel to operate the National Information System.

The first phase of this activity should be able to deliver a complete organizational activation plan in a period of two years. Coordination management would be a continuing activity which would last for the duration of the project to ensure proper continued coordination and devèlopment of the National Information System vis-a-vis organizational EDP activations.

It was agreed by all that a massive effort on a broad front is needed to accomplish the goals of a National Information System. It was felt that the U. S. Office of Education, seeing the various states acting in concert, could mobilize the necessary funds so that the large-scale funding necessary could be secured. The further organization and placement of the program office and the elements of management and control would be left for determination to the advisory group in cooperation with the U. S. Office of Education.

Summary of the Development Plan


YEARS
1967
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Pilot program
Selection
Design
Operation
National central program
Initial planning and studies
Initial computer center
Partial activation
Information system operational
Nationwide system operational
State and local EDP
Tie-in to nationwide information system for education
New installations
Initially compatible EDP
Existing installations
Modify gradually or recycle
Program Office EDP
Standards
National standards adopted
EDP packages
Program and specification preparation
EDP tie-in
50 State activation preparation

Appendix G

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Appendix I

LETTERS OF ENDORSEMENT FROM CALIFORNIA ASSOCIATION OF SCHOOL ADMINISTRATORS AND CALIFORNIA ASSOCIATION OF SECONDARY SCHOOL ADMINISTRATORS

Max Rafferty
State Superintendent of Public Instruction
State Department of Education
721 Capitol Mall
Sacramento, California 95814

Dear Dr. Rafferty:

The California Association of School Administrators is extremely interested in data processing with all of its ramifications. We have worked closely with the State Department of Education, through Dr. Grossman and his Research and Development Staff, for the past two years. Members of CASA have served on the overall advisory committee concerned with the work of the Research and Development Staff as well as on major subcommittees.

The association has endorsed this program and supports a new application for Public Law 521 funds to broaden the scope of the current project to include instructional materials and equipment, personnel and business services. We offer our continuing cooperation and assistance in the development of an educational information system that will best serve the needs of education in California.

Sincerely yours,

JAMES H. CORSON
Executive Secretary

Max Rafferty
State Superintendent of Public Instruction
721 Capitol Mall
Sacramento, California 95814

Dear Dr. Rafferty:

This Association has followed with keen interest the work of Dr. Grossman as he has evolved ideas for the establishment of regional data processing centers. We hope that every effort will be made by all concerned to continue Dr. Grossman's work in this exceedingly interesting area. This Association, having followed the progress of this work from its inception, will certainly cooperate in every way in the development of plans and procedures that may eventuate from Dr. Grossman's work.

Very truly yours,

WILLIAM N. MCGOWAN
Executive Secretary